Vapor Heating Co.,

MAIN OFFICE, YORK, PA.

Broomell's Patent Vapor System.

All the advantages of Hot Water Heating, with none of its objectionable features.

Absolutely no pressure on the radiators.

Positively noiseless.

No Air Valves used on radiators.

Radiators can be heated part way or all over, as required to properly heat the room.

Radiator Valve can be locked fast in any desired position.

Can be used with any good steam heating boiler.

Can be used with high pressure boilers or exhaust steam.

Much smaller pipes required than with any other system.

Can be installed by any experienced steam fitter.

First cost less than hot water, and will use less fuel than any other system.

Call at our Office and see the System in Operation.

GAZETTE PRINT, YORK, PA.

PREFACE.

IN presenting the second edition of the pamphlet describing Broomell's Patented Vapor System of Heating, we desire to extend our thanks to the many friends and customers with whom we have had the pleasure of dealing in the past and we very earnestly ask their continued patronage.

While the Vapor System, as heretofore installed is far superior to any other method of heating, very important and valuable improvements have been made during the past year which will make the vapor system still better and will place it so far beyond all competitors or imitators that there will be no comparison.

Correspondence is solicited from Heating Contractors, Architects and Owners.

VAPOR HEATING CO., York, Pa.

Steam Heating as It Was.

IT is not necessary in this book to present with accuracy the past history of the steam heating business. It is enough for us to know that attempts have been made to heat buildings by steam almost as far back as steam has been used in any way. In the first attempts at heating buildings by steam the methods were very crude and no system could be said to exist. In fact when we go back and investigate some of the steam plants installed even as late as twenty years ago it appears that the contractor's idea was to run as many pipes as possible and to place these pipes in every conceivable position regardless of any laws governing the flow of steam or water either under pressure or without pressure.

It appears from a study of old methods that the mechanic's idea was to place coils (cast-iron radiators at that time not being known) in such rooms as were required to be heated and then to start from the boiler with a steam pipe, always very much less in size than it should have been, and to run through all the coils in the building with one continuous circuit, then back to the boiler. Of course, this made it necessary to *heat the entire house or none*, and it also made it necessary to force the water of condensation through these various coils against the laws of gravity, with a result that before steam could be circulated at all very many drip valves and relief cocks had to be opened in various parts of the system to free the pipes from water. A very short time after the pipes had thus been relieved from water the many pockets in the system would again fill with the water of condensation, requiring all relief valves to be opened again. It was, of course, never attempted to heat buildings in this way during the night time, since the awful racket of forcing steam through pipes under the conditions named above would make it impossible for anybody in the building to think of sleep.

Steam Heating as It Is.

EVERY year since the first attempts at steam heating very great improvements have been made in the method of warming buildings by steam or hot water circulated through pipes and radiators. A great deal of study and experiment has been devoted to these branches of engineering, and we have to-day thousands of buildings all over the world heated in what may be said to be a fairly satisfactory manner. It is a fact, however, well-known to the engineering profession and steam heating contractors, as well as to very many owners, that there are still a great *many serious defects* in present methods of heating by steam or hot water. To properly understand the new system which will be described in the following pages, it is necessary to point out at least a few of the defects in existing methods.

Double Valve System.

A DOUBLE valve system is one in which two pipes are connected to each radiator—one to supply steam, the other to take the condensation back to the boiler. Two valves are required for each radiator—also an air valve. If the boiler is of ample capacity to supply plenty of steam, if all supply and return pipes with their valves and connections are of sufficient size to supply steam to all the radiators in the building and to return the water of condensation freely to the boiler, this double valve system of steam heating will give as good results as can be secured in any other plan *thus far known* to the public.

It is customary to refer to this plan as a low pressure gravity system. In this system, or any other in which the water of condensation is required to return to the boiler by gravity, it is necessary to have supply pipes of sufficient size to deliver steam to all radiators in the building *without any current of steam in the steam pipes;* or, in other words, the steam pressure in the radiators furthest removed from the boiler must exactly *balance the steam pressure in boiler.* If the steam pipes supplying indi-

HOTEL "WARWICK," NEWPORT NEWS, VA.

HEATED BY BROOMELL'S "VAPOR" SYSTEM. EXHAUST STEAM. 6,000 FEET RADIATION.

RESIDENCE OF E. C. WALKER, CONTRACTOR AND BUILDER, 500 WEST UNION ST., WEST CHESTER, PA.

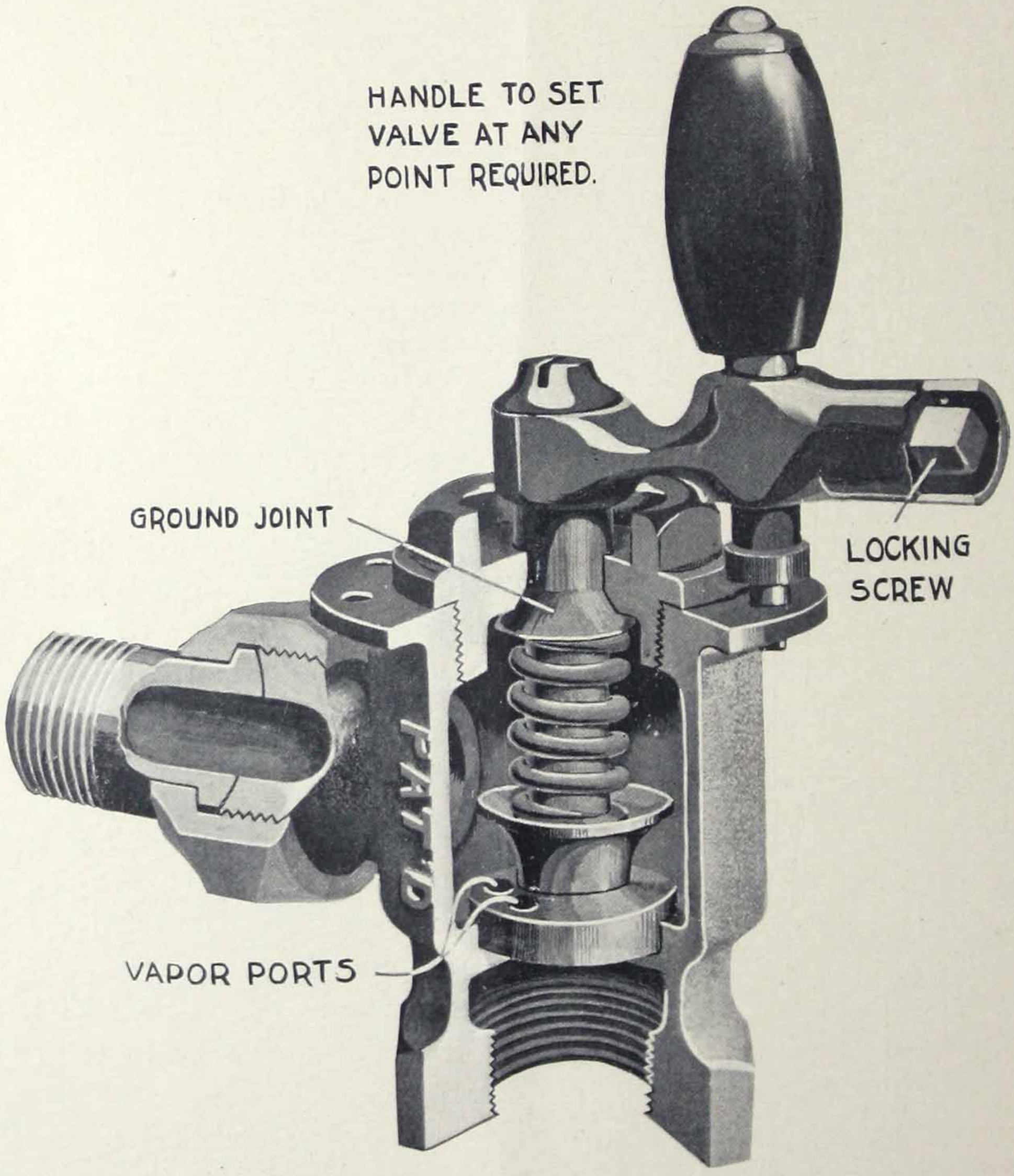
HEATED BY BROOMELL'S "VAPOR" SYSTEM.
"CAPITOL" BOILER, "ROCOCO" RADIATORS.

vidual radiators are too small, or if the main steam pipes supplying all radiators are not of sufficient size to supply these radiators without loss of pressure, there is a tendency when a radiator steam valve is opened for the water in the return pipes to rush into the radiators in an effort to fill the space which should be filled by steam. Supposing, however, this double valve system has been erected in the most careful and workmanlike manner, with every part as near perfect as is possible to make it, there are still very many serious defects which are continually giving trouble to the contractor and owner. Some of these defects may be mentioned.

When heating a building by steam it is the practice to place in each room a radiator of sufficient size to heat the room in the coldest weather. This being the case, it follows necessarily that the radiator is *too large for moderate* weather. *It is impossible to regulate the amount of steam delivered to radiators when working on the gravity system, or,* in other words, if the steam supply valve is partially shut in an attempt to control the temperature of the room by admitting less steam to the radiator, the radiator will refuse to work properly and in a short time will *fill with water.* Radiators filling with water give a great deal of trouble. If an *automatic* air valve is attached to the radiator, as soon as the water reaches this valve it will escape, with the result that carpets, furniture and ceiling are ruined. After a radiator has once filled with water and it is necessary to open a valve to again heat the radiator, the water passing from the radiator and meeting the hot steam in pipes below *will make a great noise.* This noise is so familiar to almost everybody living in a house heated with steam that it is not necessary to enter into any lengthy description.

On this plan each radiator having *two valves* makes it necessary when a radiator is to be shut off to *close both valves.* If *either* valve is left open and the other one closed, the radiator will fill with water. It being necessary to open and close radiators so frequently in order to *control the temperature* of the

(Continued on Page 10.)



SECTIONAL VIEW OF QUINTUPLE VALVE.

Sectional View of Quintuple Valve.

THE cut on opposite page is a sectional view of the Quintuple Valve used on all radiators with Broomell's Vapor System. Valves are placed at the top of the radiator for convenience. As shown on the cut the valve is shut. When this valve is connected to the supply pipe and to the radiator the supply pipe is screwed into the bottom and the nipple of the valve is screwed into the radiator. Vapor is delivered under the foot of the radiator valve, which, being in its present position with all ports closed, prevents any vapor entering the radiator. To deliver vapor to the radiator the handle is moved around one point so that the indicator pin is on the first hole. This will bring one of the ports on the valve seat directly over one of the ports in the body of the valve. If more vapor is wanted the handle can be moved to the next point. To give the valve full opening the handle is thrown around one-half turn until it stands towards the radiator in such position that four holes through the disc of the valve match the four holes in the body of the valve. Quintuple valves are made in two sizes for one-half inch and three-fourth inch pipe. The one-half inch valves are made in three numbers, No. 1, No. 2 and No. 3. The body of these valves are the same but the steam ports through the disc are made in different sizes to make the valve suitable for different size radiators.

Disc of No. 1 valves has four (4) one-eighth inch holes.

Disc of No. 2 valves has four (4) three-sixteenth inch holes.

Disc of No. 3 valves has four (4) one-fourth inch holes.

The three-fourth inch valves are also made in three numbers, No. 4, No. 5 and No. 6. The holes through the disc being of a different size. By reference to the sectional cut it will be noticed that the valve stem has no packing, a ground joint being provided in place of packing, thus removing any possibility of leakage around the valve stem. It will further be noticed that a locking screw is provided in the valve handle which when operated with a key provided for this purpose will prevent the guide pin from being pulled out of the hole in disc and making it impossible for anyone to open or close the valve unless they are in possession of a key.

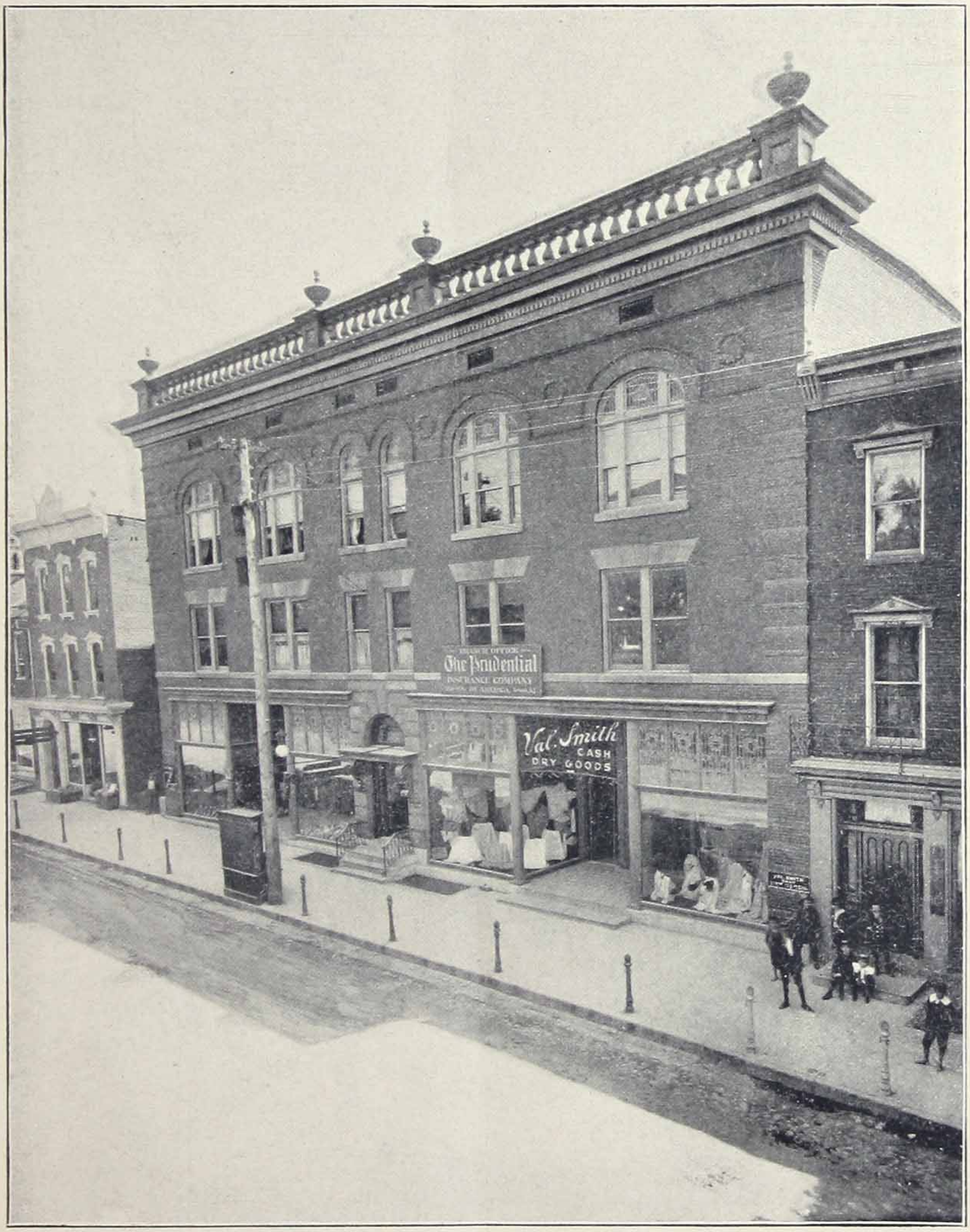
(Continued from Page 7.)

rooms, the valves, no matter how good they may be when first put on, will soon become defective and leak sufficient steam to fill the radiators with water. This continual opening and closing of radiator valves also has the effect of wearing out in a short time the *packing around the valve stems,* making it necessary to have them repacked; otherwise there is a continual leakage of steam.

Water leaking into radiators is a serious matter in another way. It will, of course, be understood that steam heating boilers do not as a rule carry very much water above the heating surfaces of the fire. Oftentimes one radiator filling will take out of the boiler sufficient to bring the water line down below the crown sheet or other exposed heating surface. If the boiler is run any length of time in this condition, *should it be a cast-iron boiler* it is certain to crack and expensive repairs are required, to say nothing of the discomforts of a cold house meanwhile. *If it be a steel boiler* it will, after a few times used in this way, blister and finally collapse entirely, requiring a new boiler.

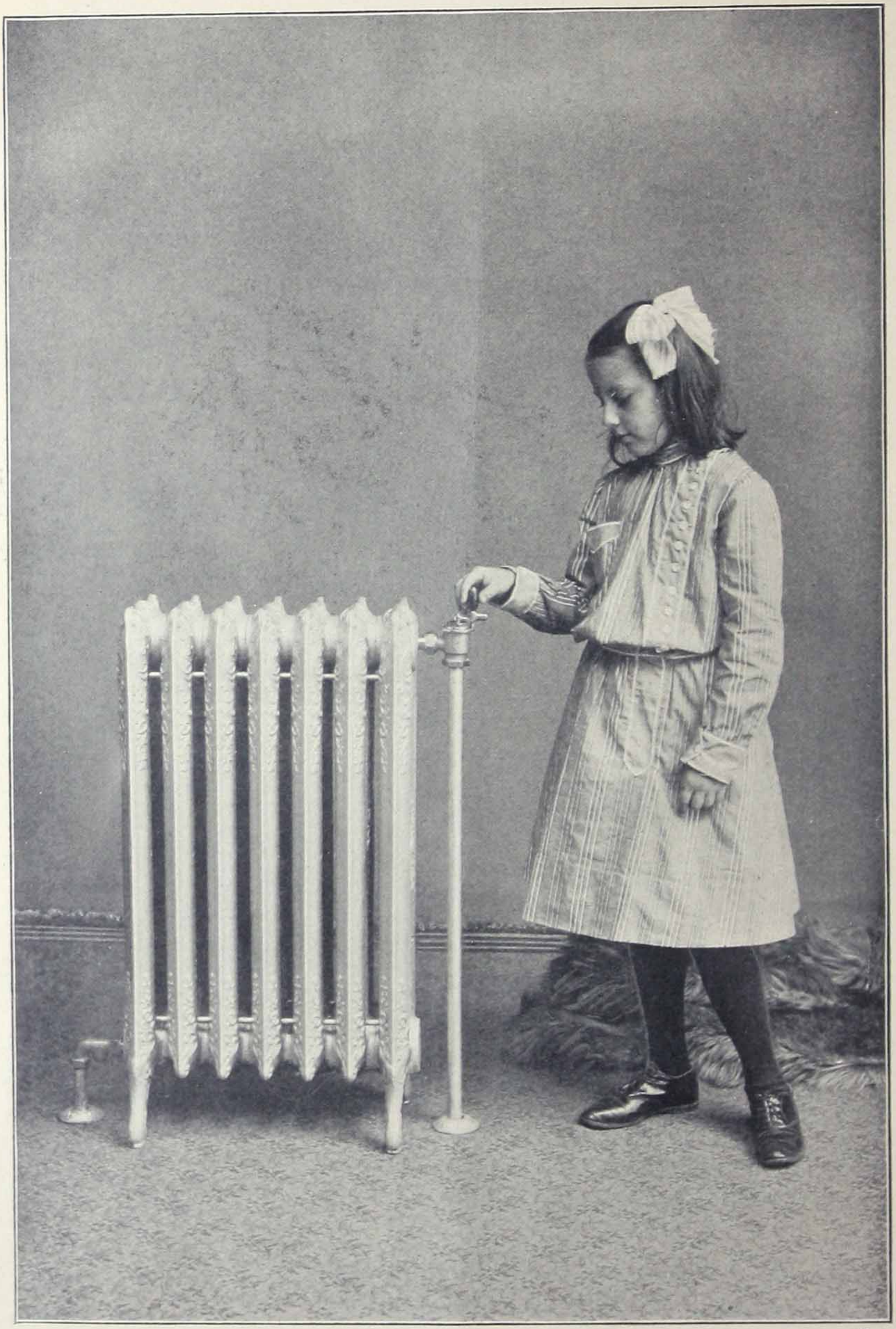
Should the attendant notice that the boiler has lost water suddenly he should go through the building and hunt for the radiators containing water, but it is not always possible to do this, and to be on the safe *side he would fill the boiler to the proper point.* Later on someone opens the flooded radiators with a result that all the water will return to the boiler, filling it oftentimes above the steam outlet, stopping the circulation of steam and causing a *tremendous pounding in the piping system.* Again, should the attendant fail to notice low water in the boiler and someone open the valve on a flooded radiator the water will rush into the boiler, *flow over the very hot surfaces* and be instantly converted into steam at a high and sometimes dangerous pressure. *Boiler explosions are frequently caused in this way.*

This plan of steam heating is defective also for the reason that every radiator must be provided with an *air valve.* If automatic valves are used, they will frequently get out of order and fail to work. *Automatic valves, being very delicate little pieces of*



"WOLFF" BUILDING, WAYNESBORO, PA.

HEATED BY BROOMELL'S "VAPOR" SYSTEM.
"KEYSTONE" BOILERS, "JOHNSTOWN" RADIATORS.
4230 FEET RADIATING SURFACE.



OPERATING "VAPOR" VALVE.

A child can open or close the valve with the thumb and finger.

mechanism, require to be adjusted and cared for by an expert; otherwise they cease to be automatic and are a source of continual trouble. If positive or hand air valves are used on the radiators, it will be necessary to open these valves in the morning *or every time steam goes down* in the boiler; otherwise the radiators will not heat when steam is again made in the boiler.

The double valve system of steam heating is also defective for the reason that very large pipes are required to supply the radiators and to return the water of condensation, making the job expensive in the first place and requiring expensive tools for doing the work. Again these large pipes present a great deal of radiating surface and be they ever so carefully covered with non-conducting material *they will consume a very large proportion* of steam which should be delivered to radiators in the rooms above.

Single Valve System.

THE single valve system is one on which only one pipe and one valve is connected to each radiator. The pipes and valves are made larger than in the double valve plan, the steam being supplied to the radiator and condensation returned to the boiler through the same pipe. Of late years this plan has increased in favor for the reason that only one valve being attached to each radiator the chances of radiators becoming flooded are reduced one-half as referred to in the remarks about double valve work. It is a notorious fact that the most careful *people are very forgetful,* and will shut one radiator valve and leave the other one open. While a *less number of pipes* are required in this plan they must be *very much larger* than on the double valve system. At first sight the single valve system seems to be less expensive, but since all valves, piping and fittings must be about double in size there is *no advantage so far as costs are concerned.* The only thing we gain in this system over the double valve is, as above stated, a reduction in the chances of having radiators flooded. *Air valves* with all their disadvantages continually discharging *the foul and dangerous gases from the radiators into the rooms* are still required. The same result will follow from *flooded radiators* in this plan as with the double pipe system. It is *impossible to regulate* the temperature of rooms by throttling or partially closing radiators valves. *The valves must be wide open or entirely shut.* When the radiator valves are closed they must be *closed tightly;* otherwise the radiators will gradually fill with water and give trouble.

Expensive tools and expert mechanics are required to properly install this system and any attempt by amateurs to put in steam heating apparatus on the single valve plan is certain to result in disasters to the contractor and very great *disappointment to the owner.*

RESIDENCE OF J. G. ROBINSON, HAMPTON, VA.

HEATED BY BROOMELL'S "VAPOR" SYSTEM.
"KEYSTONE" BOILERS, "AMERICAN" RADIATORS.

RESIDENCE OF W. H. POST, ESQ., NEWPORT NEWS, VA.

HEATED BY BROOMELL'S "VAPOR" SYSTEM.
"KEYSTONE" BOILERS, "AMERICAN" RADIATORS

Vacuum System of Steam Heating.

WHAT is known among steam heating engineers as the Vacuum System of Steam Heating, will when placed in large buildings give good satisfaction, provided sufficient attention is given to the machinery in connection with such work. With a system in which the air pump or other apparatus is used to produce a vacuum, steam can be circulated without any pressure on the heating mains. It is also feasible to regulate the amount of steam admitted to different radiators in some of the vacuum systems. These advantages, however, at least for buildings in which no expert engineer is employed, are off-set by the fact that there is a great deal of machinery required in any vacuum system, and this machinery is of quite a delicate character, requiring close attention and the care of a first-class mechanic. Each radiator in the vacuum system must be provided with two valves, one of which requires frequent adjustment. Taking it altogether, the advantages of this system have not as yet proven of sufficient value to overcome its disadvantages.

Fan System of Heating.

FOR very large buildings in which a large amount of ventilation is required what is known as the fan system or a forced circulation of warm air is oftentimes used to advantage. In this system it is customary to locate heating coils either in one large chamber in the basement or cellar or several nests of heating coils in various small chambers located at the base of the heating flues. A fan either driven by steam or electric power is used to force air over these heating coils, which, of course, are supplied with steam from a boiler of ample capacity, delivering the warm air to the different apartments above. The fan system, while very well suited to certain classes of buildings, requires a great deal of machinery and is not practical or desirable except, as above stated, for the sake of strong and positive ventilation.

(Continued on Page 20.)

PROSPECTIVE VIEW OF QUINTUPLE VALVE.

Prospective View of Quintuple Valve.

THE illustration on opposite page is another view of the Quintuple Valve shown in section on page 6. This valve is a most beautiful piece of mechanism and is gotten up in a very handsome manner by one of the most expert valve makers in the United States. It is very heavy and substantial, the finished parts all being highly polished and nickel plated. The handle for operating the valve is finished in ebony. Each valve is stamped with its number from one to six. The valve is also stamped "open" and "shut." It is perfectly steam tight, very easy to open or shut, can be locked fast in any position; it is self-packing in the valve stem and can be set with the thumb and finger to deliver sufficient steam to the radiator either to heat a very small portion of it or to discharge sufficient steam to heat the radiator from end to end. Mechanics who have examined these Quintuple Valves are unanimous in stating that it is the finest thing of the kind they have ever seen.

Compare the manner of handling the valves on Vapor System with the valves on the old plan of heating by steam or hot water. See pages 27 and 12.

(Continued from Page 17.)

Hot Water Heating.

FOR residence work and small buildings a system of heating by the circulation of hot water through radiators placed in the different rooms to be heated has some very great advantages *over any system of steam heating* at present in use. The advantages of hot water heating are that it is possible to regulate the flow of water through radiators, giving each radiator just sufficient to heat the room to any desired temperature; it is possible to retard the flow of water through a radiator until just sufficient is passing to keep the radiator from freezing, or the valve can be turned wide open and the maximum heating capacity of the radiator secured. On account of the ease with which hot water radiators can be regulated and since it is possible to regulate the fire in the heater to suit the outside temperature, as a rule less coal will be burned when the house is heated by hot water than with steam as heretofore used.

These are advantages, but they are off-set by the fact that hot water radiators, in order to heat the building in severe weather, must *be about 60 per cent. larger than radiators* using steam as a heating medium. It is frequently with difficulty that sufficient space can be found for these large radiators. They are very heavy and some people think they are unsightly. Another defect in hot water heating is that it changes in *temperature very slowly.* If unfortunately the fire is bad and the water temperature low in the morning, the house, of course, also being cold, it will require the *greater part of the day* before the house can be heated to a proper temperature. Again, after the house has become properly heated and should it be necessary to shut off radiators to prevent over heating, the radiators on account of containing such a large body of hot *water will cool slowly,* often making it necessary to open windows in order to reduce the temperature of the room. *Another serious objection* to hot water heating is the fact that thus far no damper regulator has been devised that will automatically regulate the draft in a hot water heater. This is a serious mat-

"SPEAKMAN" HOUSE, COATESVILLE, PA.

HEATED BY BROOMELL'S "VAPOR" SYSTEM.
"CAPITOL" BOILER. "JOHNSTOWN" RADIATORS

RESIDENCE OF D. W. WORTHINGTON, 3301 NORTH 16TH STREET, PHILADELPHIA, PA.

HEATED BY BROOMELL'S "VAPOR" SYSTEM.
"CAPITOL" BOILER, "ELITE" RADIATORS

ter, making it necessary for the attendant to visit the heater several times a day in order to properly set dampers and control fire.

Again, all hot water systems are erected either with an open expansion tank or on what is known as the closed system. Water when heated from 32 degrees to 212 degrees expands about 1-25 of its volume. If an expansion tank is used, this increased volume of water will find its way into the expansion tank, thus preventing any over-pressure in the system. If a closed system with relief valve is used, the expansion of water will increase the pressure, opening the relief valve and discharging the surplus water. *Both of these plans are open to serious objections.* When an expansion tank is used it must be located above all radiators, and as a necessity is often placed in an unfinished attic or other cold room, making it difficult *to prevent freezing.* Should the fire be neglected and the water get too hot it will boil in the expansion tank, and very frequently the water will be thrown out over the sides of the tank, *flooding everything below.* If a relief valve is used in place of an expansion tank, these valves oftentimes fail to work, throwing *too much pressure* on the system with a result that the radiators or pipes burst and a flood follows as a matter of course. In cold weather care must be taken that all radiator valves are sufficiently open to keep up a circulation of water through radiators, and air valves must be opened frequently. If these precautions are not taken radiators and pipes will freeze and burst making expensive repairs necessary. Every heating contractor has had the experience of repairing work ruined by freezing, and an honest contractor don't like it any better than the owner.

If no accidents of this kind happen, it is a fact that hot water systems have been used for years without any trouble. No accidents may have happened whatever and the system has given perfect satisfaction. *Without any warning* and apparently without any cause a fitting will break, a radiator loop split, bonnet of valve come off or one of the many things that can happen will transpire, giving a great deal of trouble, expense and annoyance.

These accidents always happen in the *coldest weather.* Hot water heating also requires very large supply and return pipes, and requires the best kind of workmanship, together with expensive tools to properly install the system.

Heating as It Will Be—Vapor.

TAKING it for granted that all well posted heating engineers, as well as users of steam or hot water heating apparatus will acknowledge that existing systems are defective not only as pointed out in the previous chapters but in many other respects, any system that will be entirely free from these defects and objections is certainly something to be desired. The heating system of the future will be so constructed that it will have the following points of superiority and excellency:

The boiler, the most important part of any heating apparatus, will be constructed in such a manner that it will be absolutely safe from explosion or breakage; it will be easily managed and taken care of; will be arranged in such manner that all heating surfaces can be readily cleaned. *The boiler will be economical in the use of fuel* and so constructed that it will burn the kind of fuel most readily obtained in that locality in which the boiler is to be used. The operation of the boiler, so far as its water supply and regulation of draft is concerned, will be as near automatic as possible. The boiler will have a low water line and the height of boiler over all will be such that it can be readily placed *in low cellars.*

The other parts of the heating system must have equal merit with the boiler and be constructed in such manner that leaks on boiler, pipe joints or radiators are impossible. *The entire heating* system must be constructed so every radiator can be used independently from all others. *It must be possible to regulate the temperature* of any radiator to suit the requirements of the weather. The entire system must be simple and free from complicated fixtures of any kind. **Broomell's Vapor System of Heating, a heating system having all these de-**

sirable qualities and free from every defect due to present systems has been invented, carefully tested, perfected in all details, and will be described on the following pages.

The new system is known as "Broomell's Vapor System," so called because of the fact that all heating is by the vapor arising from *boiling water not under pressure,* the temperature of vapor never exceeding that of boiling water, 212 degrees.

The vapor system has all the advantages of hot water heating with none of its defects. All the desirable features of steam heating heretofore used will be found in the new system, but every one of the objections against all the other systems of heating are eliminated in new plan. *This system is applicable to buildings of every class, from the smallest residence to the largest business house, hotel, school building, church or factory.* The Vapor System will work in the most satisfactory manner when steam is taken from street mains. A special receiver and regulator is furnished for this class of work. The Vapor System will also operate to great advantage from high pressure boilers or exhaust steam. *Any good steam heating boiler* can be used with "Broomell's Vapor System," the only requirements being that the boiler has an ample capacity to fill all radiators with vapor in the coldest weather, that it has a nicely fitting and easily moving damper in smoke pipe, *and that the water line of the boiler be at least four feet below the joist overhead.* Leaving the selection of a suitable boiler to the heating engineer or owner and starting from the boiler, the following description of the "Vapor" System will enable anyone to understand its great advantages and its adaptability to the heating of all classes of buildings. To make the description a little more clear the system may be divided into the followng parts:

First. The combined receiver, relief apparatus, pressure gauge and draft regulator. Page 36.

(Continued on Page 28.)

SPECIAL NOTICE.

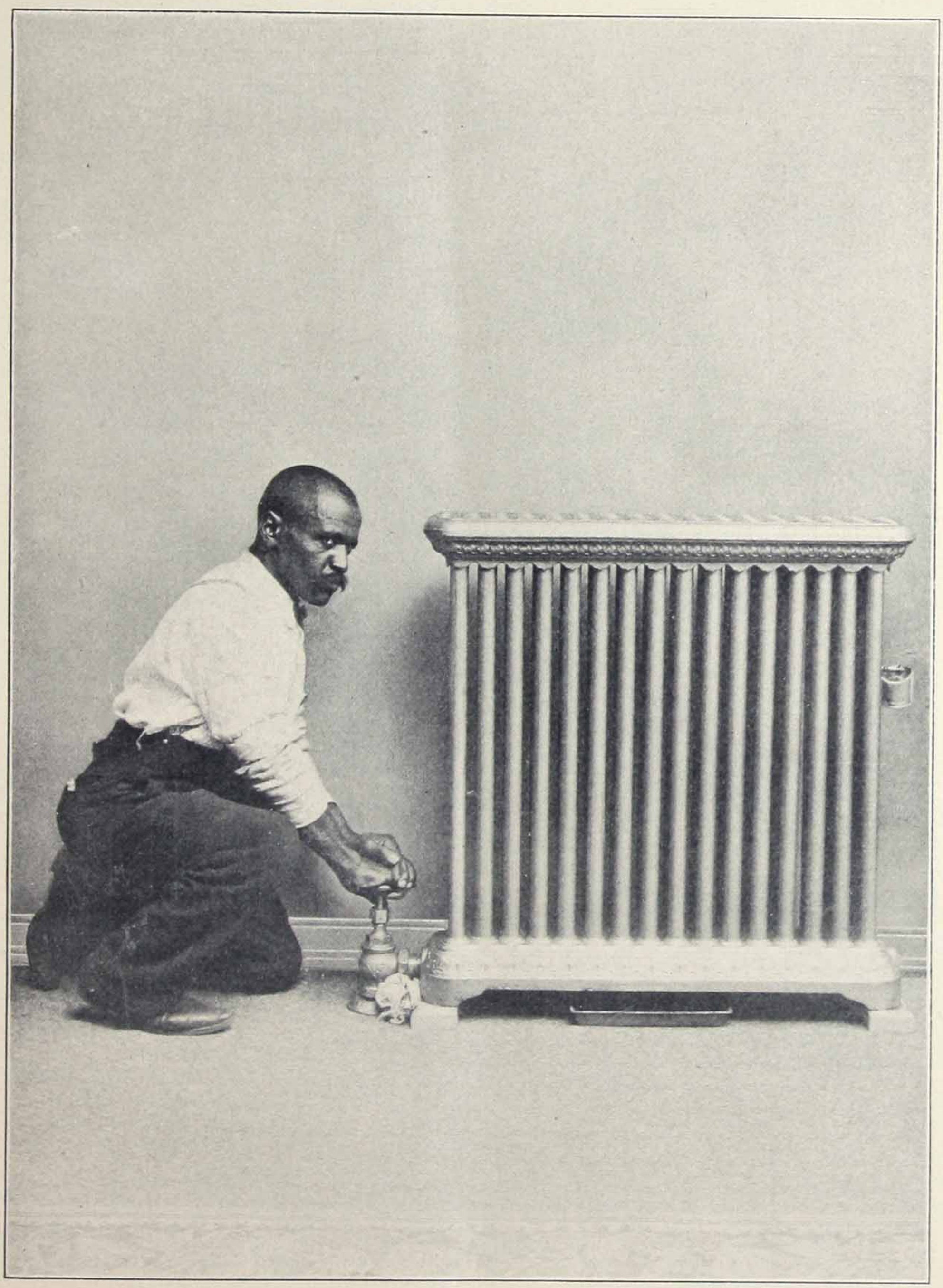
IT is the aim of the Vapor Heating Co. to work entirely through the heating trade and the Vapor Heating Co. do not care to take contracts for the installation of Broomell's Vapor System in buildings except in special cases. In the event of parties ordering the Vapor system from sections of the country in which there are no heating contractors, or in the event of heating contractors declining to bid on plans and specifications furnished by the Vapor Co., or should it develop that there is any combination between different heating contractors to name to the owners prices which are unreasonable, then we are ready to take care of our customers and will contract for all of the material and for the erection of the work complete.

We are prepared always to furnish boiler, radiators, pipe and material of every kind required for any particular job, and will name a price for everything shown on the drawings and called for in the specifications delivered on board cars at York, Pa., or at railroad station nearest to the building.

Correspondence in regard to these points respectfully solicited.

VAPOR HEATING COMPANY,

YORK, PA.



OPERATING VALVE ON STEAM RADIATOR.

It is frequently necessary to call on a strong man to open or close valves. Valves and radiators are continuously leaking. Compare this with page 12.

(Continued from Page 25.)

Second. The quintuple radiator valve, illustration and description of which will be seen on pages 8 and 18.

Third. The special union elbow. Page 41.

Fourth. The condensing radiator and connections.

Referring to illustration on page 24, the combination receiver will be seen attached to the boiler with a return pipe from the bottom of the receiver connecting into the boiler below the water line. *Attached to each radiator near the top will be seen the quintuple valve.* Above the boiler in the cellar and connected to the receiver with a steam pipe will be noticed a condensing coil. From the top of the condensing coil on the opposite end from the pipe connecting the condensing coil to the receiver, a pipe is taken down and its end is run into the smoke pipe or smoke chimney. *This creates a suction and a partial vacuum through the entire system equal to the draft of the chimney, the tendency being to exhaust the air from the radiators and to pull the vapor into them as soon as the radiator valve is opened. Particular attention is called to the fact that the combined receiver is open to the atmosphere through the condensing coil, making any pressure whatever in the receiver impossible.* It will further be noticed that the radiators are open to the atmosphere through their return pipes, which connect into the top of the receiver, *thus making it impossible for the radiator to receive pressure.* When in use the operation of the system is as follows:

Having filled the boiler to the proper level as indicated by the water gauge, it will be noticed that the same water level is shown in the glass gauge attached to the combined receiver and its pipe leading into the boiler. After fire is made in the boiler and before any actual steam is generated, and before any pressure is produced in the boiler, the quintuple valves on radiators being open, the hot vapor arising from the water will flow through the main supply pipe in the cellar and thence to the radiators through the small connecting pipes and the quin-

water gauge, it will be noticed that the water level is shown

RESIDENCE OF WM. CHALFANT, JR., WEST CHESTER, PA.

HEATED BY BROOMELL'S "VAPOR" SYSTEM.
"CAPITOL" BOILER, "ROCOCO" RADIATORS

RESIDENCE OF T. W. MARSHALL, WEST CHESTER, PA.

HEATED BY BROOMELL'S "VAPOR" SYSTEM.
"CAPITOL" BOILER, "ROCOCO" RADIATORS.

tuple valves. *The air with which all radiators are filled* when cold is drawn out through the return pipes by the suction of the chimney, and will pass out through the condensing coil and its connecting pipe. The water of condensation formed in the radiators as they become heated will flow through the small return pipes and will be discharged into the top of the receiver, from which it will return to the boiler by gravity through the connecting return pipe.

The construction of the quintuple valve is explained on pages 8 and 18. This valve is made in such a manner that *any desired quantity of* vapor can be admitted to the radiator; the maximum quantity admitted, however, being just sufficient to nicely heat the radiator *from end to end in the coldest weather.* All valves are numbered from No. 1 to No. 6, according to the size of the delivery ports through the valve disc.

When the radiator is hot all over and is doing its maximum work the return water will be of such temperature that some vapor will pass down the return pipes and into the receiver. *It is at this point that the condensing coil comes in.* All vapor arising from the water of condensation which is being discharged into the receiver will pass from the receiver through the connecting pipe into the condensing coil, where it is condensed and will return *to the receiver in the form of water.*

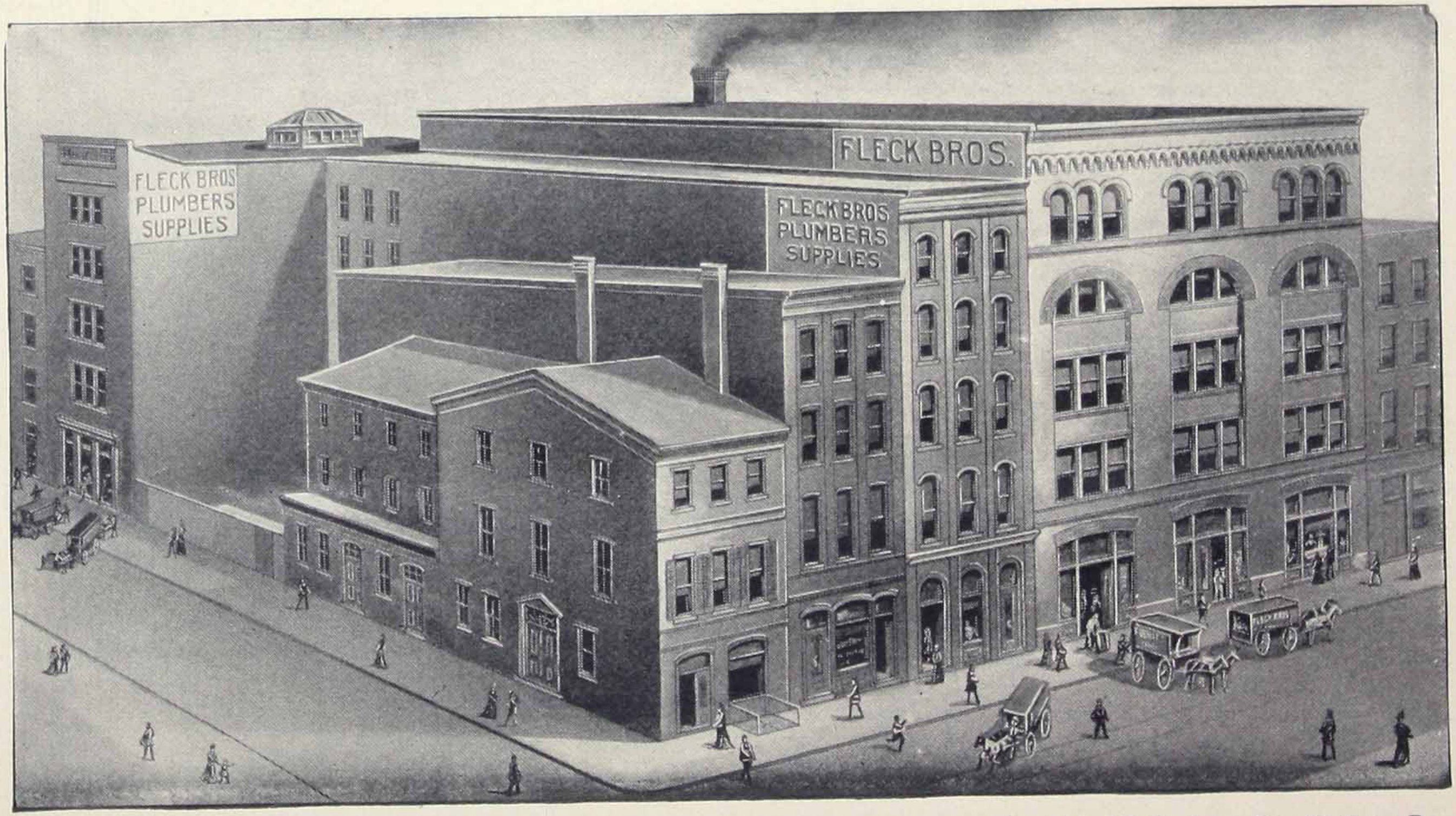
The fact that all radiators are open to the atmosphere makes it possible to circulate vapor through them without any pressure on the boiler.

In the event, however, of all or part of the radiators being shut off the boiler may make more steam than is condensed, in which case a slight pressure will be produced in the boiler, and there will be a tendency to depress the surface of water in the boiler, and to elevate the surface of the water in the receiver. A glass gauge is attached to the side of the receiver, back of which is a graduated scale which will measure the elevation of the water and *indicate the pressure on the boiler by ounces,* thus forming an absolutely accurate pressure gauge. See illustration of gen-

eral plan page ~~10~~ 44; and illustration of receiver page 36. The distance between the water line in the boiler and the extreme high water line in the receiver will in no case exceed 2 feet. *The maximum pressure,* therefore, that can ever be in the boiler will equal a column of water 2 feet high or, say, one pound per square inch. Supposing pressure to gradually accumulate in the boiler, the water line in the glass gauge on receiver will change and as the water of condensation comes into the receiver from the different radiators it will accumulate in the receiver until it reaches sufficient height to overcome the pressure in the boiler, when it will flow into the boiler by gravity.

Should the pressure continue to increase the water in the receiver will gradually accumulate until it reaches the *draft regulating float* which has been set to the desired point as described on page 37, when this float will be raised by the action of the water and the damper of the boiler will be closed; damper is connected to the float by a brass chain as shown in the general plan. This makes the most satisfactory and most accurately working automatic draft regulator ever devised, opening or closing the damper entirely on change of *two ounces in pressure and at any point between 2 to 16 ounces pressure on boiler.* Should the closing of the damper fail to check the increase in steam pressure, the water in the receiver will continue to accumulate until the float in the receiver reaches the lever attached to the relief valve described on page 37, when the action of the water will lift the safety valve, which will immediately reduce the pressure in the boiler, the water in the receiver will drop and the relief valve will close.

In previous chapters we pointed out the impossibility of regulating the amount of steam delivered to any particular radiator. In all other systems it will be remembered that radiator valves must be *wide open* (otherwise the radiators will fill with water), heating the radiators from end to end, no matter whether the weather be mild or severe. *With "Broomell's Vapor System,"* and by the use of the quintuple valve illustrated and described on pages 8 and 18, it is not only possible but very easy to regulate



OFFICES AND STOREROOMS OF FLECK BROS., PLUMBERS' SUPPLIES, NOS. 44-48 N. 5TH ST., PHILA., PA.
HEATED BY BROOMELL'S "VAPOR" SYSTEM.
"MERCER" BOILER.

the amount of vapor delivered to any radiator; admitting sufficient to keep the radiator barely warm, to heat it up to a moderate degree, or to *fill* it entirely, thus heating the radiator from end to end so it will work to its maximum efficiency. **In this particular we have all the advantages of hot water heating,** the radiators being heated to only a moderate temperature will give off the same delightfully mild heat so much appreciated by users of hot water heating systems. As noted in the description of quintuple valve, this valve is so made that ¼, ½, ¾ or full opening on can be secured. It frequently happens that unoccupied rooms should have sufficient heat to keep the temperature above freezing or to take off the chill. In the ordinary systems of steam heating this is impossible, the consequence being that the radiators must be run to their full capacity and a great deal of heat oftentimes wasted. With the "Broomell Vapor System" the valve can be opened ¼ or ½, just sufficient to temper the room and at the same time a very trifling amount of steam will be used from the boiler. With this system it is also possible when it is desired to heat the room quickly to open the valve on the radiator to its full capacity until the radiator has been thoroughly heated from end to end, when it can be gradually reduced until the valve is open only one-half or one-quarter of its full capacity. *By this means the temperature of the room can be held at any desired point continually.*

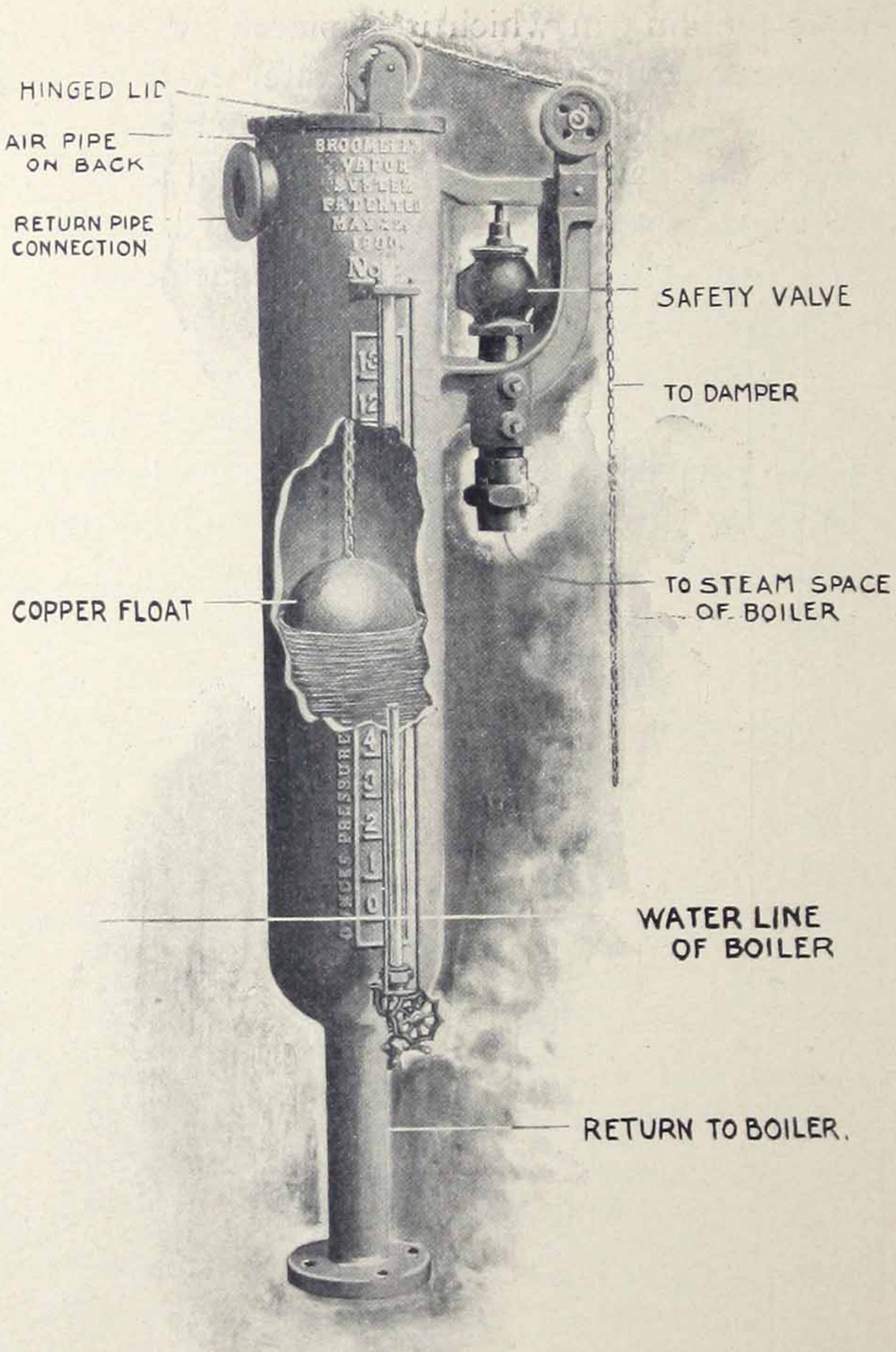
With "Broomell's Vapor System" and by use of the patented quintuple valve it is an *absolute impossibility for radiators to fill with water.* You can turn a radiator on or off as often as you please and it will never make the least noise. *The nuisance of leaks around radiator valve stems,* air valves and joints so frequent in ordinary steam heating apparatus is unknown in the "Vapor System."

While the quintuple valves can be handled with a thumb and finger without stooping, and can be set accurately to deliver any required amount of heat to the radiator, *they can also be locked fast in any* desired position only to be changed by the person holding the proper key. This is a very desirable feature in resi-

dences, preventing children from moving the valves, or in schools, hospitals, churches, etc., where the regulation of heat should be attended to by one person only.

"Broomell's Vapor System" has the great advantage of capacity to heat the building in which it is placed in the most severe weather without over-heating in moderate weather. Radiators for the "Vapor System" are made about 10 per cent. larger than when used with old plans of steam heating, and they have ample surface to meet the requirements when blizzards strike and the thermometer registers way below zero. At such times heat, and plenty of it, is wanted, and wanted at once.

The Vapor System can be put in at a less cost than hot water and is much better when done. The larger the building, the greater will be the saving. Smaller pipes are used requiring only such tools as every steam fitter has. Pipes and fittings, as well as pipe covering, will cost much less than for water and the work is a great deal less.



COMBINED RECEIVER, RELIEF APPARATUS AND DAMPER REGULATOR.

For plan of connecting to Boiler see page 44.

Combined Receiver, Relief Apparatus and Damper Regulator.

THE cut on opposite page is a view of the improved and new pattern receiver for use with the vapor system. On another page will be found an illustration showing the method of connecting the receiver to the boiler. This new receiver is so constructed that it will close the damper of boilers at any point between zero and 16 ounces. By referring to the cut it will be noticed that the receiver is a round cast iron cylinder with an open top which is covered by a hinged lid. On the face of the receiver is a glass gauge running from zero mark to the extreme top. Back of the glass gauge is a scale graduated to show ounces of pressure. Inside of the receiver is placed a copper float. This float is carried by a brass chain which passes up through the centre of the hinged lid, from which point it is carried to the damper of the boiler. At the right hand side of the receiver and attached to the steam space of the boiler is placed a safety valve. This is a special safety valve designed to go with the vapor system. Resting on the top of the safety valve stem is a lever which projects into the top of the receiver cylinder. This lever is weighted to hold the safety valve shut against whatever pressure may accumulate. The operation of the receiver and damper regulator is as follows:—

All return pipes from the building are connected into the side opening of the receiver. By lifting the hinged top at any time the amount of condensation returning to the receiver can be seen. *This top must never be left standing open.* If there is no pressure on the boiler the water in the receiver will stand on an exact level with the water in the boiler, which should be at the zero mark of the receiver. When any pressure is produced in the boiler the water will accumulate in the receiver until it overcomes the pressure in the boiler, when it will flow into the boiler by gravity. Supposing the float which controls the damper has been set to the 8 ounce mark, when the water rises in the receiver to that point it will come in contact with the float and lift it, which will cause the damper of boiler to close. If the closing of the damper prevents any increase in steam pressure the water will remain stationary in the glass gauge. If, however, the steam pressure increases after the damper has been closed, the water will continue to rise in the receiver and will carry with it the float, which has already closed the damper, and the float will then come in contact with the lever extending in from the relief valve, and will lift this lever with the result that the safety valve is immediately opened and the pressure in boiler relieved. The water will then immediately drop in the receiver, and if it comes down below the point where the float has been set to close the damper, the damper will be opened. The great advantage of this new receiver is its simplicity, freedom from anything like levers, fixtures or steam joints, and the fact that it is possible to close the damper at any point between zero and full pressure. In moderate weather it is sometimes desirable to close the damper on one or two ounces pressure. In colder weather the float can be set to close the damper at eight or ten ounces, as may be required. *The fire door of boiler and the ash pit doors should be kept closed and the pressure on boiler regulated entirely by the automatic regulator.* The smoke pipe on boiler should have a hand damper which can be set at any point. The automatic damper regulator should be connected to the lifting door in the ash pit and also to a damper in smoke stack. *It is absolutely necessary that these dampers work very freely and that the ash pit damper is very light and easily handled.*

Small Fuel Consumption of the Vapor System.

THE question of economy in fuel is an important consideration in deciding what heating system should be chosen. Broomell's Vapor System has the merit of not only being far superior in every other way to other methods of heating but also of being able to do more heating work per pound of coal than any other. Engineers and experts who have examined the Vapor System are unanimous in saying that it cannot fail to work with great economy. All tests and experiments made during the past two winters where the system has been in actual operation prove that the coal consumption is very small.

It is not hard to find an explanation for this very satisfactory feature of the Vapor System. Several things combine to bring about this result.

The small supply and return pipes go far in the direction of economy. In other systems 25 per cent. of the boiler capacity must be used to supply the heat that is lost through large pipes. In the Vapor System less than 10 per cent. is required. The close regulation of the temperature attainable with the Vapor System is greatly in favor of small fuel consumption. Any system that cannot be regulated to suit the requirements is certain to be an extravagant consumer of fuel.

Another peculiarity and very desirable feature of the system is its power of transmitting to the room to be *warmed all of the heat delivered to the radiators.* The hot vapor direct from the boiler is expanded in the radiators and is all absorbed and condensed, *every heat unit being given up to be used in warming the room.* The water of condensation flows back to the boiler through the small return pipes at a very low temperature and entering the boiler at the bottom, naturally absorbs heat very rapidly from the hot fire of the furnace which is in direct contact with the plates of the boiler. This feature at once gives the boiler working on the Vapor System a very great advantage.

FOURTEEN HOUSES FOR G. W. AND J. M. ZANE, 22ND & TIOGA STS., PHILADELPHIA, PA.

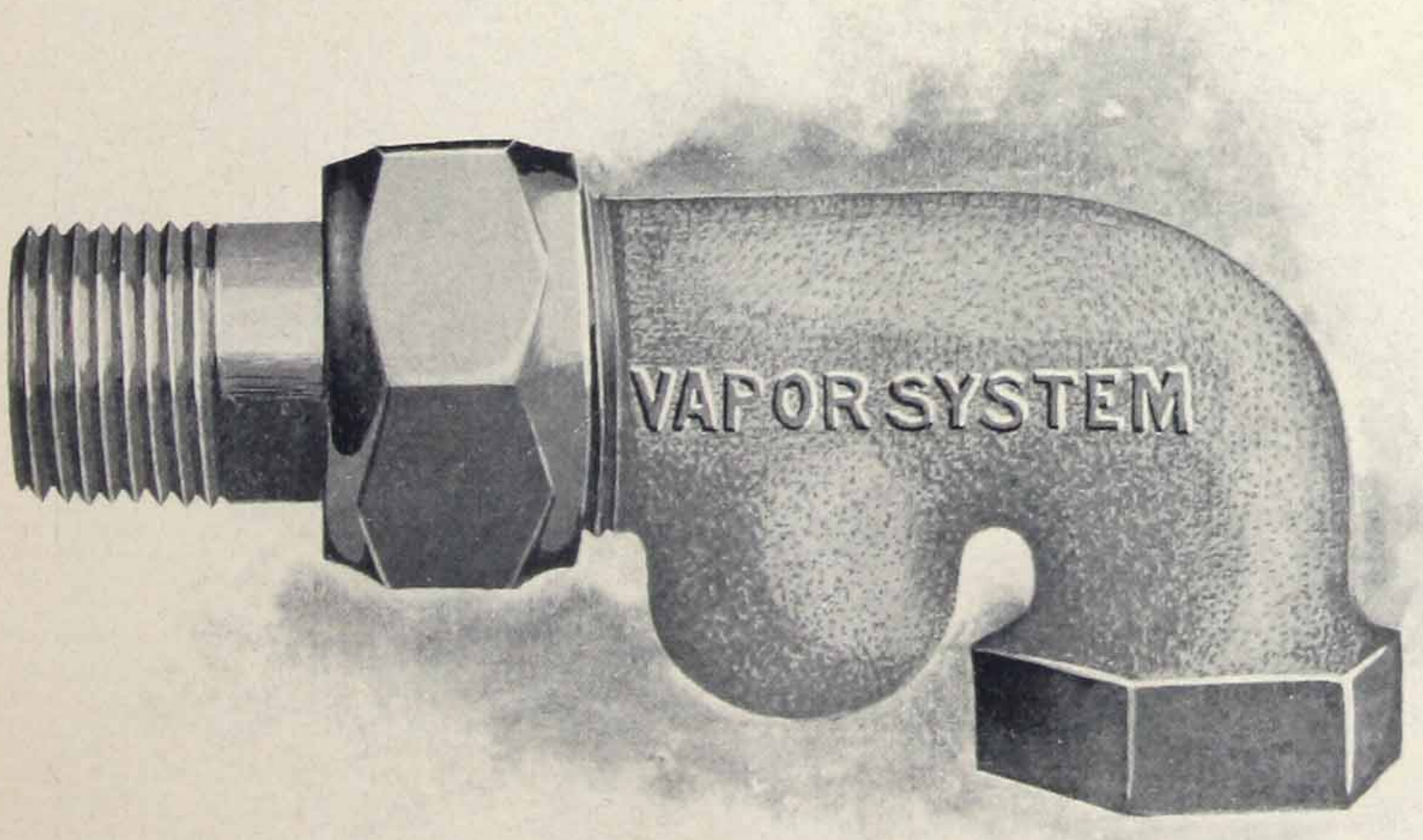
HEATED BY BROOMELL'S "VAPOR" SYSTEM.
"RICHMOND" BOILERS, "ROCOCO" RADIATORS.

HOTEL BUILDING, J. R. PETIT, 54TH ST. & WYALUSING AVE., WEST PHILADELPHIA, PA.

HEATED BY BROOMELL'S "VAPOR" SYSTEM.
"RELIANCE" BOILER, "SOLAR" RADIATORS.

Perhaps, the one thing more than any other that makes the Vapor System an economical one is the fact that *radiators are never air bound.* The continuous suction on the return pipe of radiators is strong enough to pull all air out of them leaving a partial vacuum, not only permitting but assisting the vapor to circulate through the entire radiator and to come in contact with every inch of heating surface. Air bound radiators work at a great disadvantage and are wasteful of fuel.

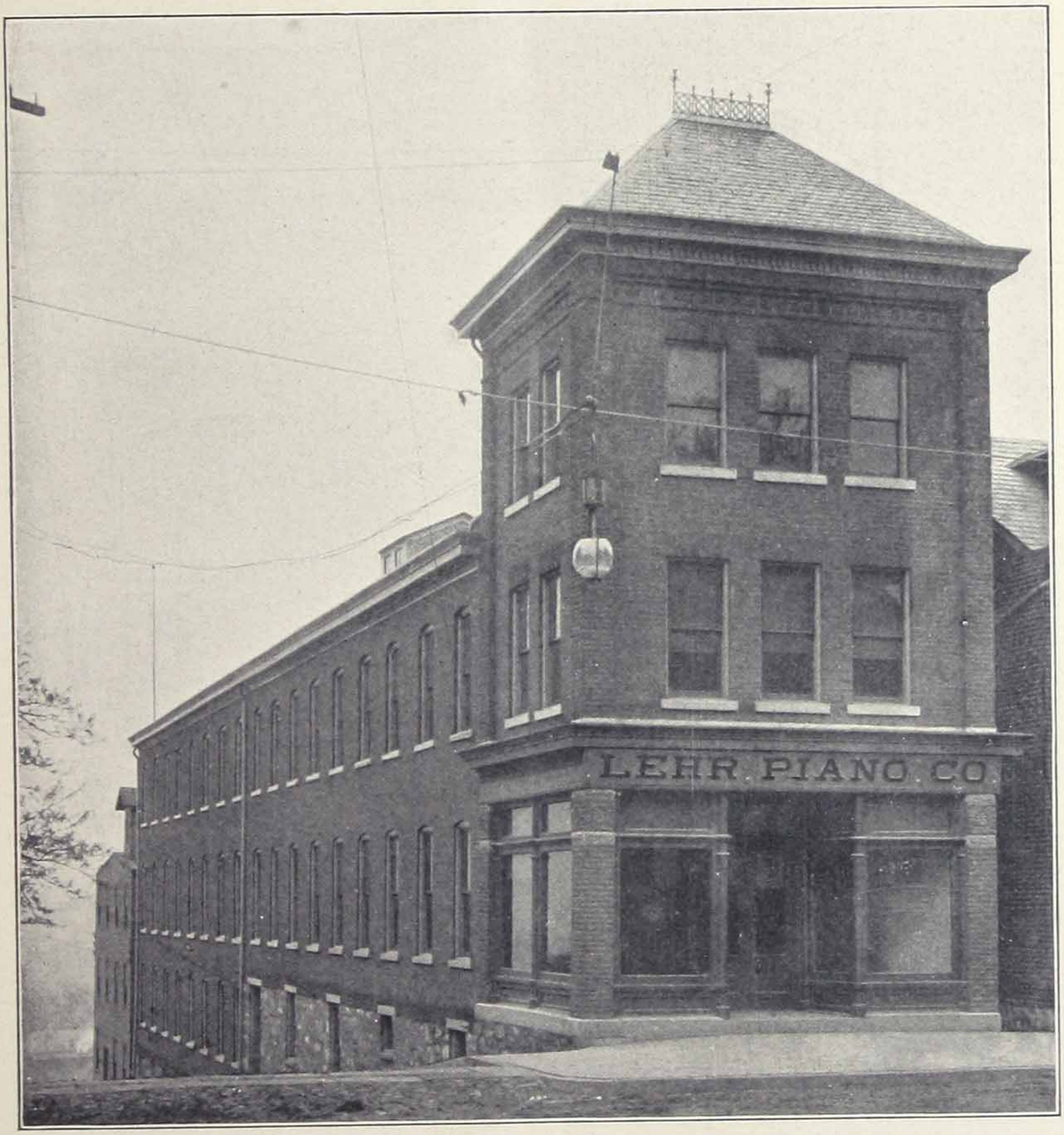
Many thousands of dollars have been spent in the attempt to make a perfect automatic air valve for use on radiators without success. No air valves of any kind are used on Broomell's Vapor System and this fact alone, saying nothing of all other advantages, at once makes the Vapor System more desirable than any other.



SPECIAL UNION ELBOW FOR RETURN END OF VAPOR RADIATORS.

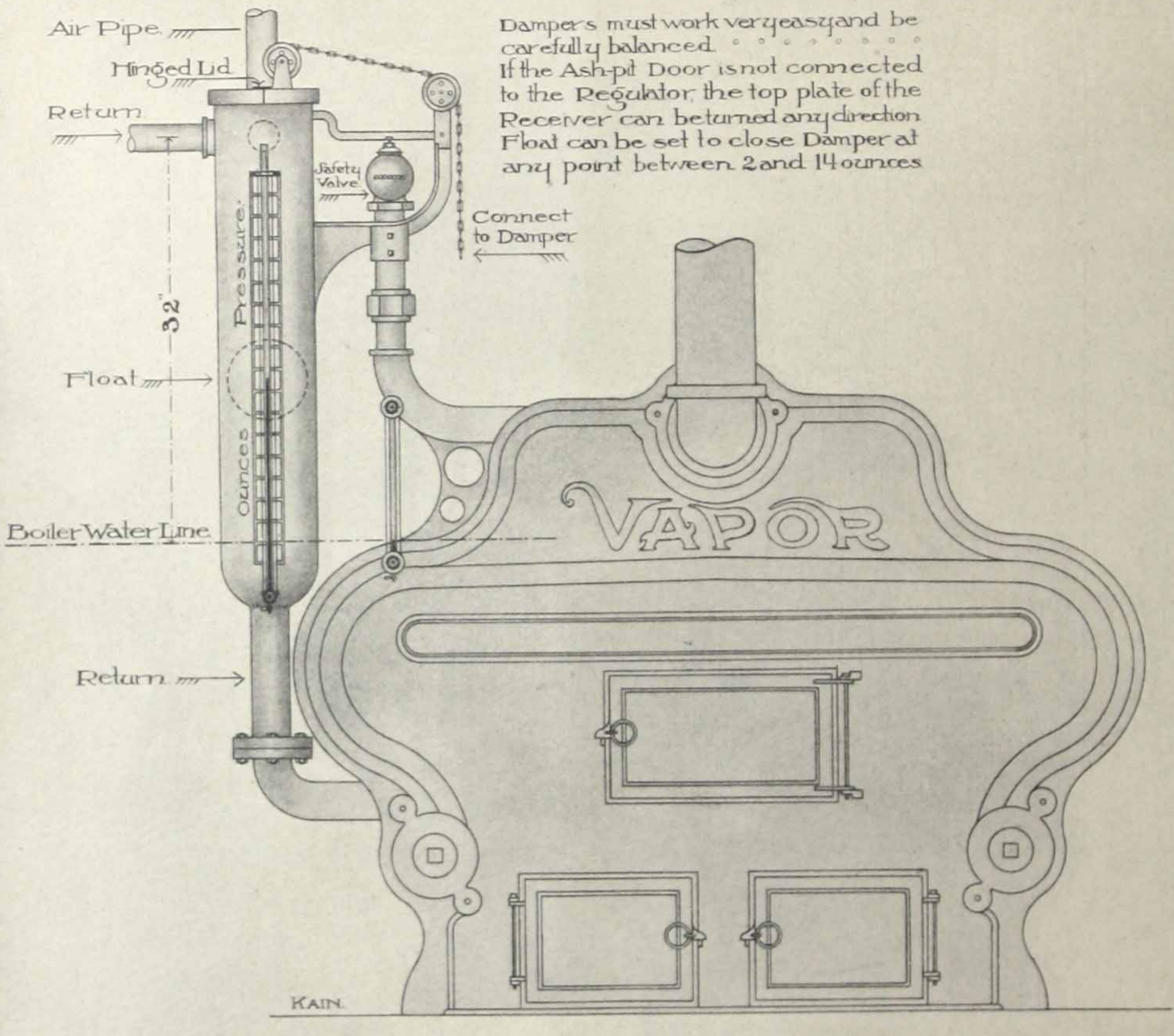
JONES BUILDING, NEWPORT NEWS, VA.

HEATED BY BROOMELL'S "VAPOR" SYSTEM.



LEHR PIANO WORKS, EASTON, PA.

HEATED BY BROOMELL'S "VAPOR" SYSTEM.
"CORNELL" BOILER.



Dampers must work very easy and be carefully balanced.
If the Ash-pit Door is not connected to the Regulator, the top plate of the Receiver can be turned any direction.
Float can be set to close Damper at any point between 2 and 14 ounces.

PLAN OF CONNECTING NEW PATTERN RECEIVER TO BOILER.

o mark on receiver must be placed on a level with water line of boiler. See page 37.

Boilers.

AS previously stated, any good steam heating boiler of suitable design can be used with the Vapor System. On account of the system requiring dry or overhead returns, which must enter the top of the receiver, which is 32 inches above the water line of boiler, it is advisable to use a boiler having a low water line, otherwise it will be necessary to pit the boiler which should be avoided wherever possible.

When determining the size boiler to be used about 10 per cent. should be added to the radiating surface required in the building for mains. Then use a boiler rated as near as possible to this amount. Boilers will carry somewhat more surface with the Vapor System than with steam.

The Vapor System is now in use with almost every style and make of heating boiler in the market. In the first edition of this pamphlet several different makes of boilers were illustrated with the patent vapor receiver attached. Those illustrations have been omitted from this edition and only one cut of boiler is shown. The illustration on opposite page does not show any particular boiler, but is given to show the manner of attaching the new pattern receiver. The receiver can be used with any heating boiler of suitable design. The requirements being a low water line and the *zero mark on the receiver must be placed on a level with the water line of boiler.*

Important Notice.

BROOMELL'S Vapor System of Heating as well as the special valves, union elbows and automatic receiver are protected by American, Canadian and English patents. All correspondence in reference to the system must be addressed to the VAPOR HEATING COMPANY, YORK, PA.

Price lists of specialties and cost of license for the use of the system will be furnished to the Heating Trade on application.

Note to Architects and Owners.

THE Vapor System can be installed in buildings which present no unusual conditions in a perfectly satisfactory manner by any experienced steam heating contractor without the aid of any drawings except such sketches as are usually furnished the workmen for their guidance. It is often desired, however, when a large building is to be heated, or when there are unusual conditions to be met, to have full and complete drawings and specifications covering the entire installation.

The Vapor Heating Co. have constantly in their employ a large force of experienced heating engineers and draftsmen and are prepared to furnish to architects and owners complete plans which are made in detail and with the greatest care. These plans and the accompanying specifications are so full and complete that there is no possible chance for misunderstandings or mistakes, and when the work is installed in accordance with the drawings the job is perfect.

Since such drawings and specifications as we prepare are expensive, we cannot agree to furnish them without some satisfactory understanding. Correspondence is solicited from interested parties.

Architects and owners will find it to their advantage to specify the Vapor System, and we will guarantee that our plans and specifications will be satisfactory and will insure the very best work at the lowest possible cost.

VAPOR HEATING COMPANY,
YORK, PA.

Don't Forget.

THE Vapor System is adapted to buildings of every kind and size. No building is too large or complicated for this system. It works perfectly from High Pressure Boilers, with exhaust steam and from the street systems.

How to Order.

IF you are considering the matter of heating any building, whether it be large or small, and no matter what kind of a building, we will be glad to have you send us particulars as to size, location, number and size of rooms, etc., with sketches if possible, showing the different floors of building to be heated, and we will advise you approximately the number of radiators and the amount of radiating surface required. We will also advise as to the approximate cost of the complete job.

If, on receipt of this information, you conclude to adopt the system for your building, and will so advise us, we will prepare the drawings and specifications. Drawings and specifications will be made in duplicate so that the owner can retain one copy for his own use while the other is being used to secure bids for the work.

Quintuple Valves.

ALL radiators working on VAPOR must be fed through Broomell's patent Quintuple Valves. See pages 8 and 18. These valves are a patented specialty and are made only by the VAPOR HEATING CO., of York, Pa. Valves must be placed at the top of the radiators and care must be taken to use the proper number of valves on the different size radiator. See list of valves and pipe sizes.

Special Union Elbows.

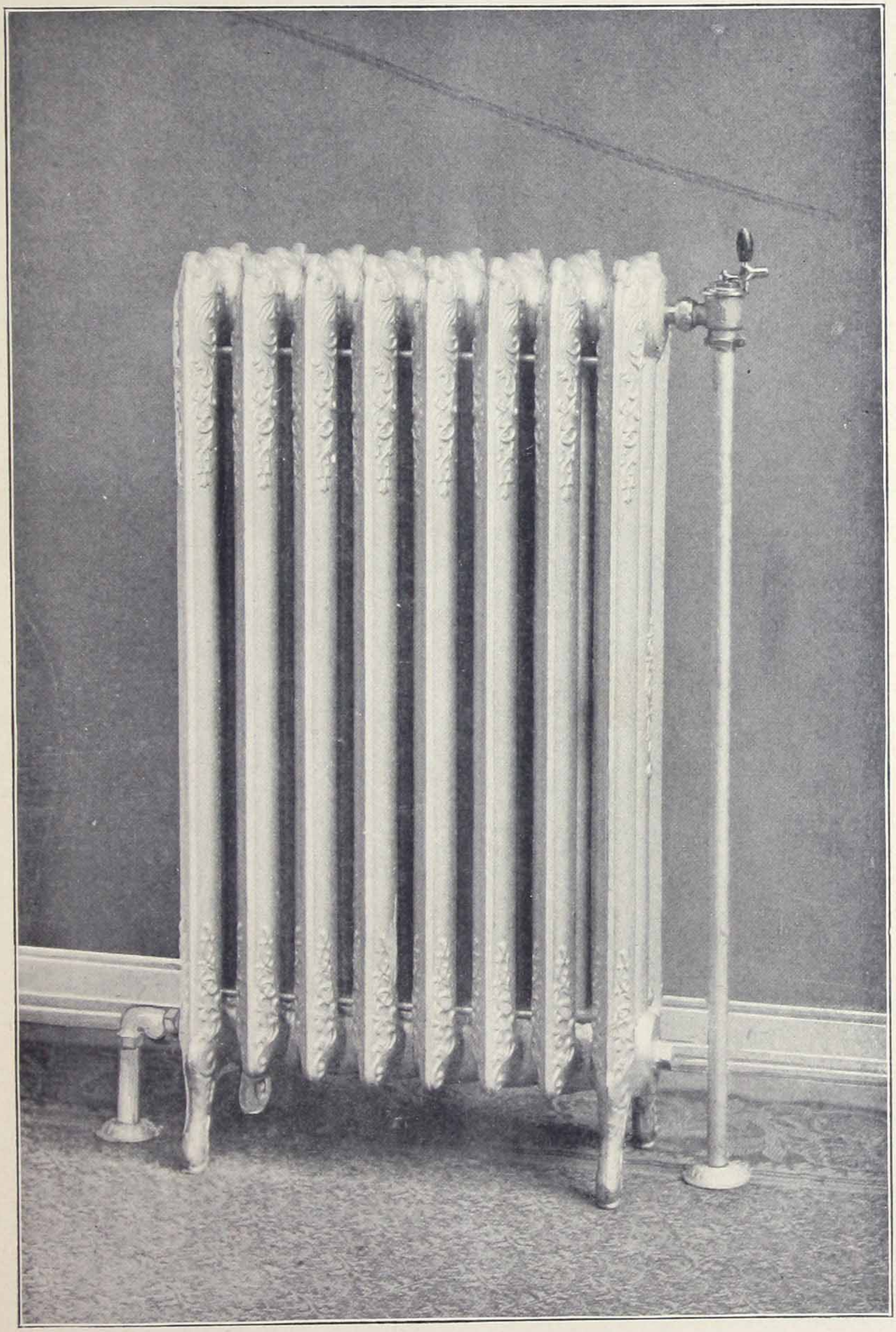
THE return end of all radiators must be connected to the return pipes by Broomell's Improved Union Elbow, cut of which is shown on page 41. This elbow is of special design and is so constructed that the condensation is freely discharged from the radiators and the air is removed automatically and at the same time there will be no tendency for the radiators to heat from the return line when the supply valve is shut.

Combined Receiver and Regulator.

THE receiver and regulator, which is described and illustrated on pages 36 and 37, is a very important part of the vapor apparatus. The receiver can be attached to any suitable steam heating boiler. The zero mark on the receiver must be on a level with the water line of the boiler. All returns must be carried back overhead to the receiver, the condensation being returned to the boiler and the air taken out through the condensing coil and delivered into the smoke chimney.

Condensing Coil.

A SPECIAL condensing coil is furnished by the Vapor Heating Co. with their other specialties and this coil must be attached to all vapor plants. The coil is placed on the ceiling of the boiler room in the most convenient position between the receiver and smoke chimney. A pipe connection is taken from the air opening on the receiver to one end of the condensing coil and from the other end of the condensing coil an air pipe is connected into the smoke chimney or smoke pipe. The condensing coil must be set with the end next to the receiver, two or three inches below the other end, so that any condensation forming in the coil will run back to the receiver by gravity. *In operation, if this condensing coil is hot all over and remains hot any length of time, it is evidence that some of the radiators are equipped with valves too large and that too much vapor is being discharged back to the receiver.* In this case it is well to go over the building and, if possible, note which radiators are discharging too much vapor and then set the Quintuple Valves back one port.



RADIATOR CONNECTED ON "VAPOR" SYSTEM.

Radiators.

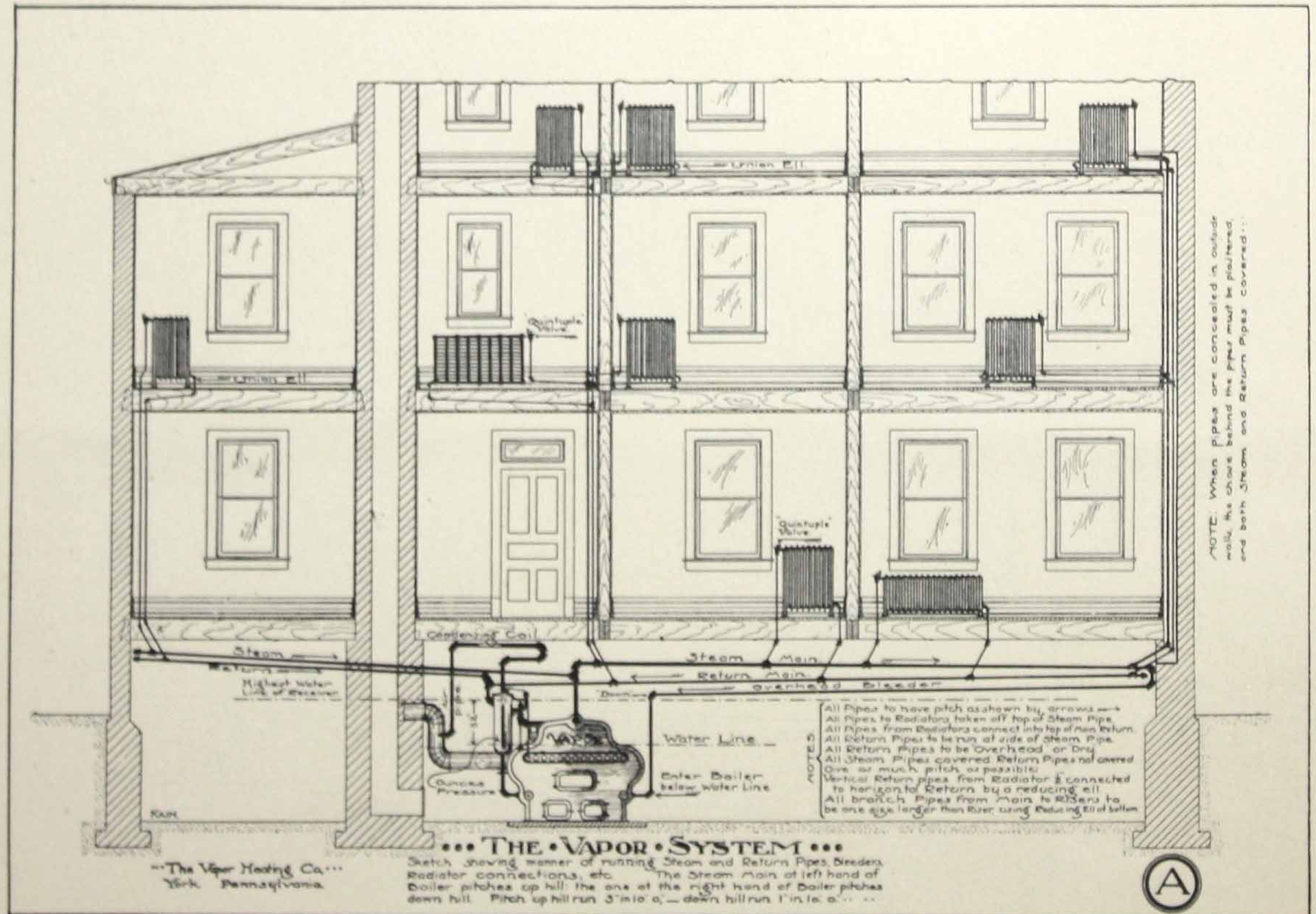
ANY good radiators can be used with the vapor system but all radiators must be the hot WATER PATTERN with inlet at the top. Don't use a three or four column radiator if you can get enough surface in a two column which will give better results than where the radiators are too short. Low radiators and Fowler Coils are recommended as giving excellent satisfaction. Use plenty of radiating surface. Plenty of surface means satisfaction to your customer, economy, and more orders—for every good job sells two others. The temperature of rooms can be regulated no matter how large a radiator may be placed and in order to be ample for extreme cold weather and blizzards, radiating surface should be figured strong, and it is advisable to use about 10 to 15 per cent. more radiating surface with the vapor system than with steam heating. It is much better to spend a little extra money in sufficient radiation in the first place, rather than be compelled to enlarge radiators after the work is finished.

Methods of Piping for the Vapor System.

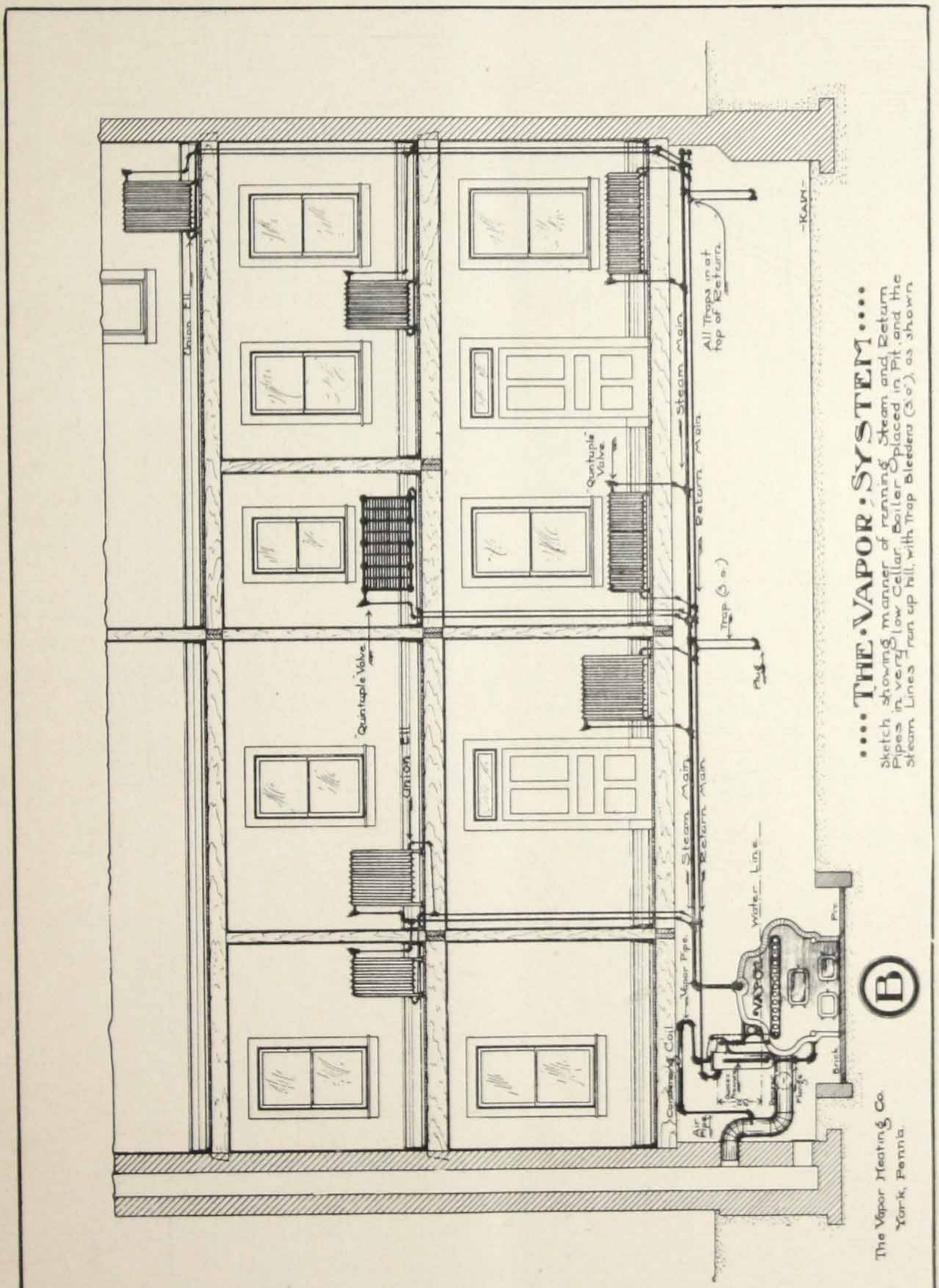
See cuts A, B, C, D and G.

THE Vapor System resembles steam heating inasmuch as the main supply pipes in the cellar must be so run that they will remain perfectly dry and free from water. Any good lay-out will work satisfactorily, the same method being employed to secure a dry line as is required for a double-pipe system of steam heating. Up-hill mains, with frequent bleeders three-fourth to one and one-fourth inch size as shown in drawings A, B, C and D, work perfectly and the pipe lines present a neat appearance. Care must be taken to so proportion the cellar mains as to distribute the steam evenly all over the building. The radiators furthest removed from the boilers must have a steam supply equal to those close to the boiler. This result can always be accomplished by using a circuit system of piping around the cellar. In very many jobs it is advisable to feed the circuit at two points, the main supply should be connected into the circuit line at its highest point. The auxiliary supply which should not be as large as the steam supply can be connected in at the most convenient point and at the point which will best balance the steam distribution. All experienced steam fitters understand fully about the necessity of a dry steam line and how to secure as well the best distribution of steam. The Vapor System, however, is being put in by fitters all over the world, some of whom have not had a very great deal of experience. It is to the latter more particularly that these instructions apply.

All branch pipes from the main to the risers should be taken off at the top of the main and should be one size larger than the riser with a good pitch toward the main and connecting to the riser by reducing elbow. When two radiators are taken off of one riser no matter how small the radiators the riser should be increased one size. If a very large radiator is supplied by a riser, or if the riser runs more than one story it should be increased one size. Above the floor where the radiator connection is made a reducing socket can be used in the riser. All return pipes in the Vapor System must be overhead or dry and must pitch toward the receiver. These pipes should have a pitch of about 1 inch in 10 feet. No steam or return pipes in the cellar less than three-fourth inch should be used. The Vapor Heaing Co. will furnish drawings for any building, if sufficient data is supplied showing all pipe sizes.



MAINS RUN UP AND DOWN HILL FROM BOILER.

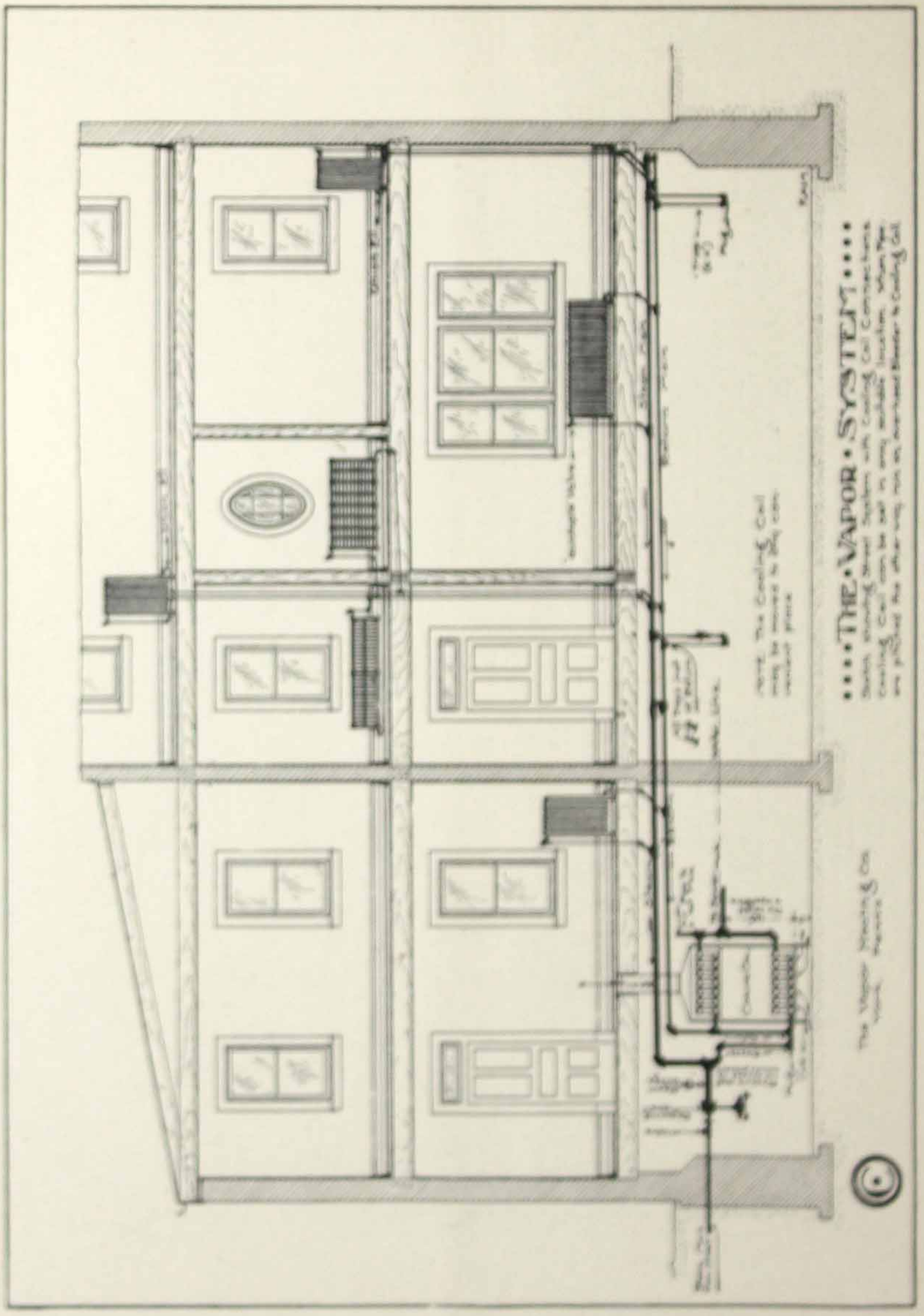


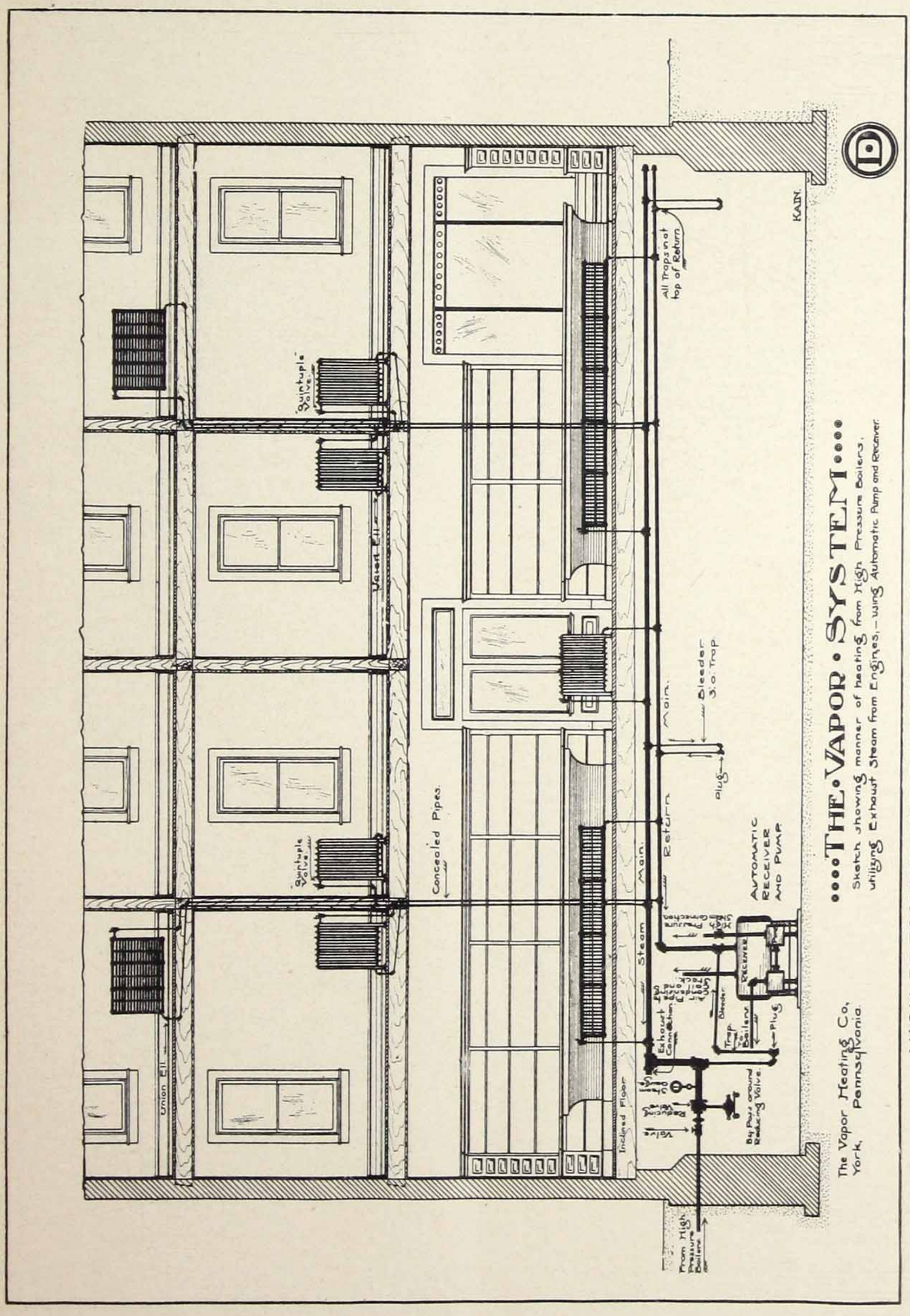
MAINS RUN UP HILL FROM BOILER. "TRAP" BLEEDERS.

•••• THE VAPOR SYSTEM ••••

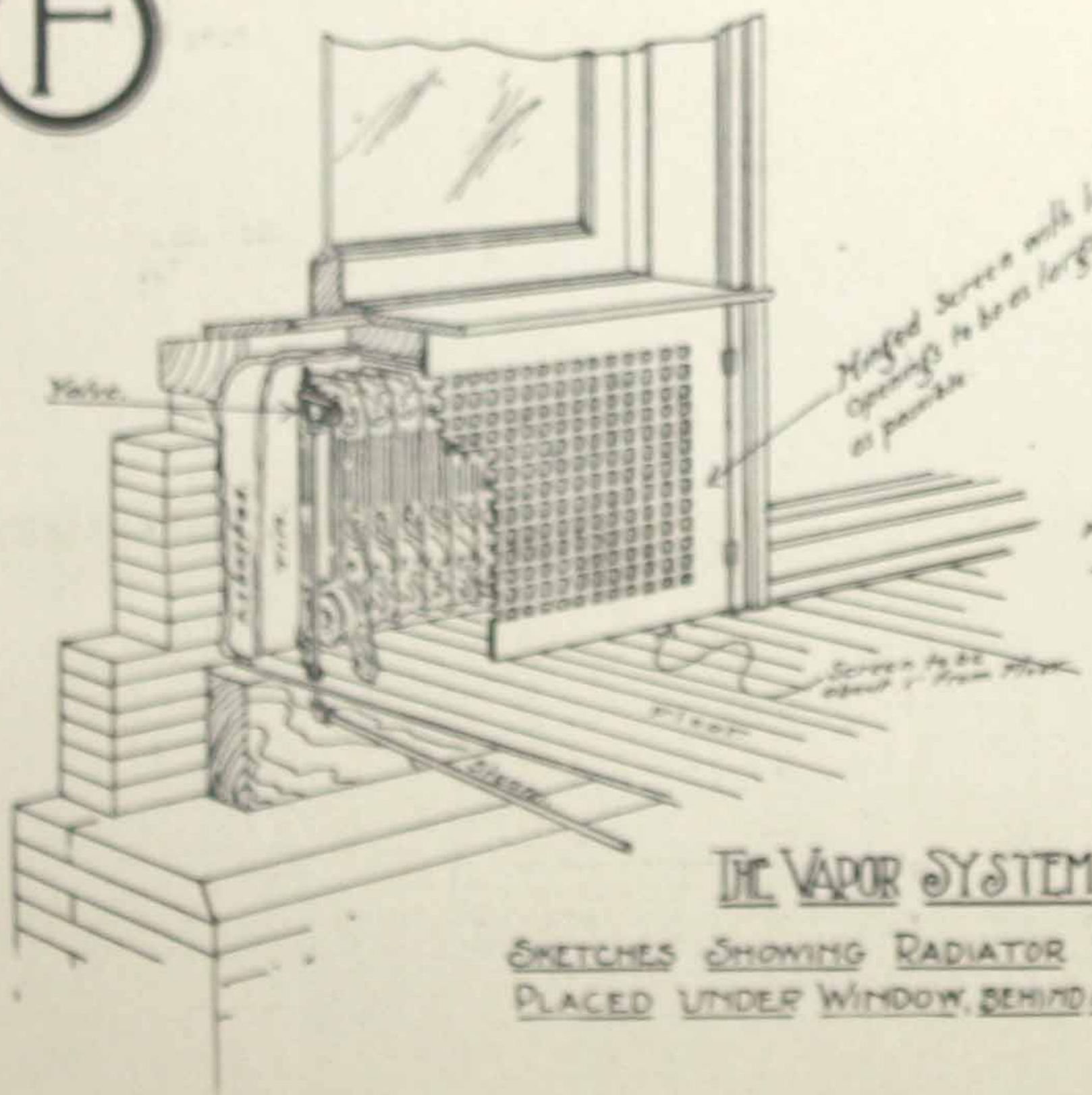
Sketch showing manner of running Steam and Return Pipes in very low Cellar. Boiler placed in Pit, and the Steam Lines run up hill, with Trap Bleeders (3'0"), as shown

The Vapor Heating Co
York, Penna.

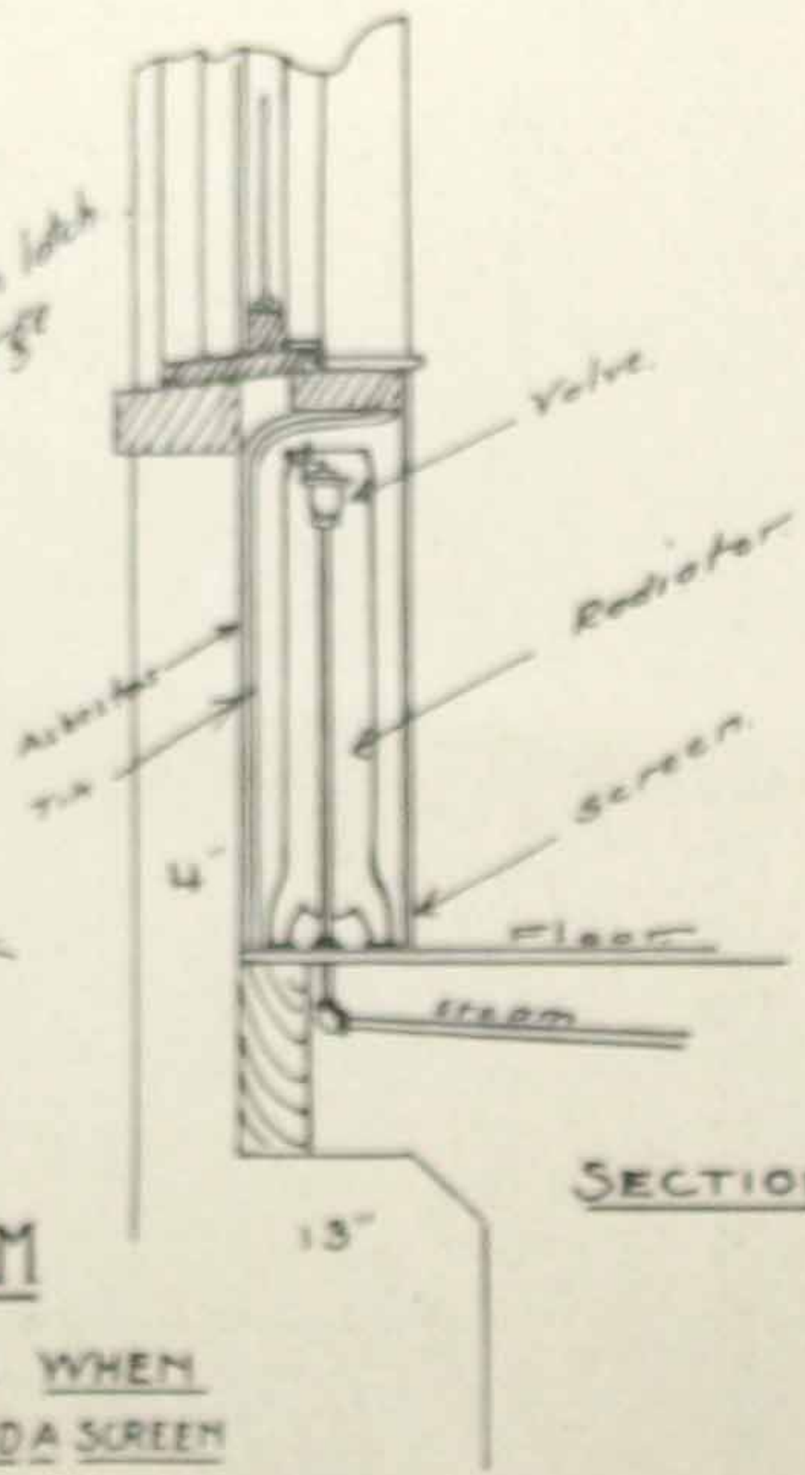

THE VAPOR SYSTEM
STEAM FROM STREET MAIN.


HIGH PRESSURE AND EXHAUST STEAM. MAINS RUN UP HILL.
THE VAPOR SYSTEM
Sketch showing manner of heating from High Pressure Boilers, utilizing Exhaust Steam from Engines, — using Automatic Pump and Receiver.
The Vapor Heating Co,
York, Pennsylvania.
Main
Return
Bleeder
Plug
Automatic Receiver and Pump
Steam Main
Concealed Pipes
Quintuple Valves
Union Ell
Inclined Floor
By Pass around Reducing Valve
From High Pressure Boiler
KAIN.

F



PERSPECTIVE.



SECTION.

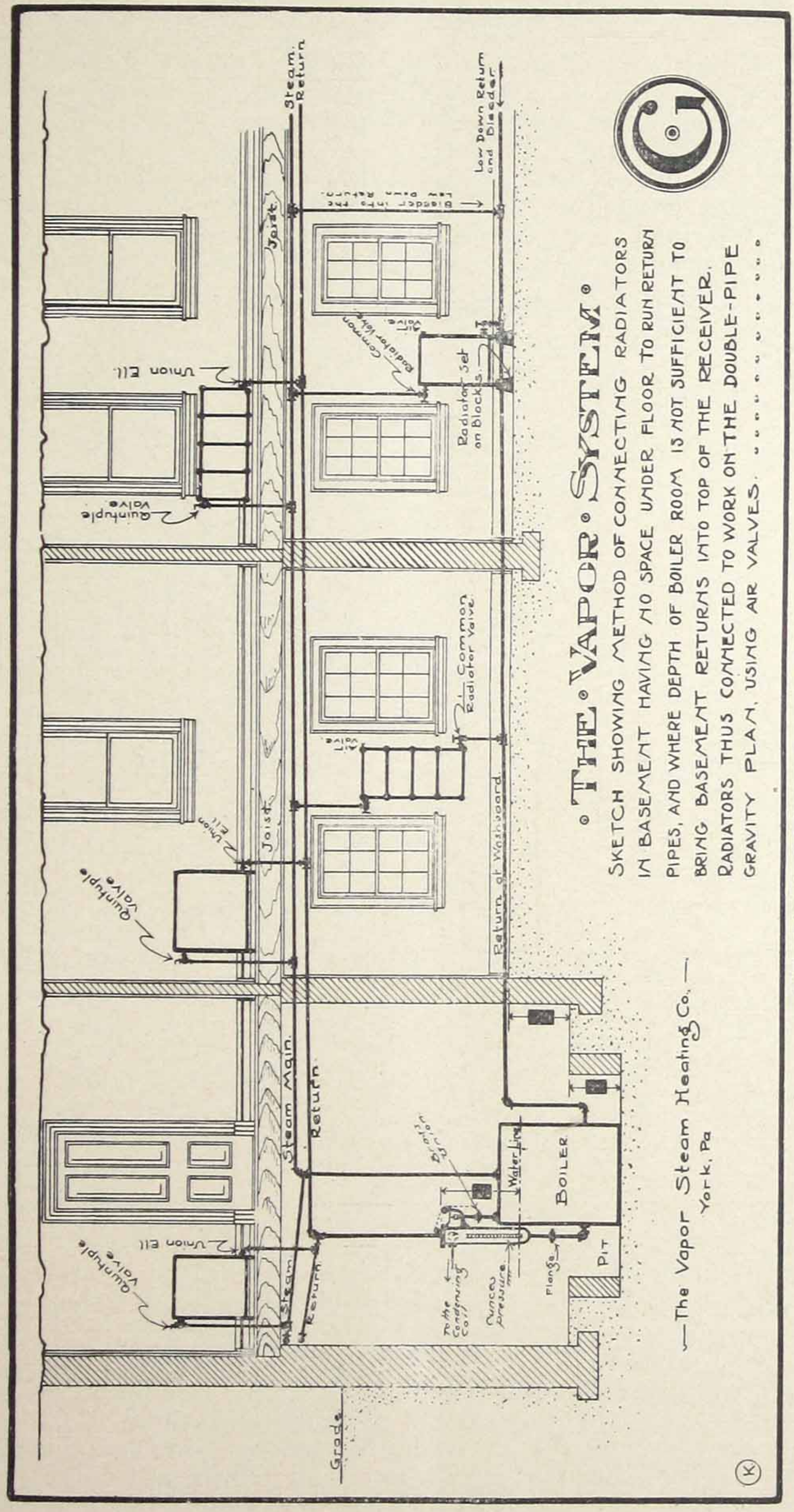
THE VAPOR SYSTEM

SKETCHES SHOWING RADIATOR WHEN PLACED UNDER WINDOW, BEHIND A SCREEN

Scale 3/4" = 1' 0"

The Vapor Steam Heating Co.
York, Pa.

56



"VAPOR" SYSTEM

SKETCH SHOWING METHOD OF CONNECTING RADIATORS IN BASEMENT HAVING NO SPACE UNDER FLOOR TO RUN RETURN PIPES, AND WHERE DEPTH OF BOILER ROOM IS NOT SUFFICIENT TO BRING BASEMENT RETURNS INTO TOP OF THE RECEIVER. RADIATORS THUS CONNECTED TO WORK ON THE DOUBLE-PIPE GRAVITY PLAN, USING AIR VALVES. . . . . .

—The Vapor Steam Heating Co.—
York, Pa

HEATING BASEMENT RADIATORS.

(K)

Radiating Surface Required.

No set rule for determining surface can be applied without taking into consideration all conditions. Everything depends on the construction of the building, location, exposure, number of doors and windows, direction and severity of prevailing winds, etc , etc.

If good judgment is used, the amount of radiating surface can be determined by using the schedule given below, this being calculated for a climate such as Central Pennsylvania when the minimum temperature is about 10 degrees below zero with a good deal of windy weather.

Direct Radiating Surface Required.

Kind of Building.							
		Protected rooms on warm side of building, with few windows and no outside doors.	Protected rooms on warm side of building, with several windows, and two sides exposed.	Medium exposed rooms on cold side of building, with few windows and no side exposed.	On cold side of building, two sides exposed, with several windows, no outside doors.	On cold side of building, three sides exposed, with several windows, and outside door.
Residences	Direct radiation per cubic foot space required to heat to	75°	1 to 40	1 to 35	1 to 30	1 to 25	1 to 20
Office Buildings		70°	1 to 50	1 to 45	1 to 40	1 to 35	1 to 30
School Rooms		65°	1 to 60	1 to 55	1 to 50	1 to 45	1 to 40
Churches.							
Main Auditorium		70°	1 foot of direct radiation to every 70 cubic feet of space.				
" "		70°	1 foot of semi-direct radiation to every 60 cubic feet of space.				
Store Rooms.							
Exposed front and back only		70°	1 foot of direct radiation to every 80 cubic feet of space.				

NOTE.—The above calls for more surface than is ordinarily used with direct steam, but when using the Vapor System (like Hot Water Heating) it is advisable to use a very ample amount of radiating surface.

Plenty of surface means coal saved. By the use of the Patent Quintuple Valve the temperature can be regulated to any point, and then, when very cold weather comes, the owner has the radiation to heat his building properly.